DOCUMENT RESUME

ED 239 589 IR 010 951

TITLE Potential Roles for Public Television Stations in the Emerging Interactive Videodisc Industry. An Evaluation.
INSTITUTION Butterfield Communications Group.
SPONS AGENCY Corporation for Public Broadcasting, Washington, D.C.
PUB DATE 11 Oct 83
NOTE 132p.
PUB TYPE Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS Case Studies; *Educational Media; Expenditures; *Marketing; Prediction; *Public Television; *Publishing Industry; Surveys; *Training; Use Studies; *Videodisc Recordings
IDENTIFIERS Entertainment; *Interactive Video

ABSTRACT

This document explores the potential involvement of public broadcasting in interactive videodisc. It includes a survey of current videodisc uses in entertainment, publishing, marketing, training, and education. Individual chapters focus on each of the market segments in terms of historical growth, present growth, and likely future growth, with special emphasis on the potential each segment holds for interactive videodisc applications. Factors likely to influence videodisc success in these applications are identified and evaluated, and a projection is made of the share of software expenditures in each market segment that interactive videodisc has the potential to capture. Case studies provide insights into decision and implementation processes for each application. Additional chapters analyze the current structure of the videodisc industry based on extensive interviews with industry participants as well as basic research. Recommendations for strengthening the position of public broadcasting in the videodisc industry include both objectives and strategic approaches for achieving them. An appendix presents information on government training expenditures. (LMM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED239589

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Potential Roles for Public Television Stations in the Emerging Interactive Videodisc Industry

An Evaluation

Submitted to

Corporation for Public Broadcasting

by

Butterfield Communications Group

October 11, 1983

IR010951

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Eleanor C. Miller

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TABLE OF CONTENTS

Page

Preface

INTRODUCTION i-1

SUMMARY OF FINDINGS i-2

CHAPTER 1 - VIDEODISC: DEFINITIONS AND HISTORY I-1

A. OVERVIEW OF VIDEODISC SYSTEMS I-2
Videodisc Player Capabilities I-2
Videodisc Design Formats I-3
Optical Laser Disc Format I-4
Capacitance Electronic Disc (CED) I-5
Video High-Density (VHD) Videodiscs I-6

B. HISTORICAL BACKGROUND OF THE INDUSTRY I-6

C. THE STRUCTURE OF ANALYSIS ADOPTED FOR THIS REPORT I-9

CHAPTER 2 - TRAINING II-1

A. THE TRAINING MARKET FOR MEDIATED MATERIALS II-2
Industry Spending for Training Software II-3
Government Spending for Training Software II-4
Government Spending for Non-personnel Training II-6

B. CURRENT TRAINING APPLICATIONS OF INTERACTIVE VIDEODISC II-6

C. PRODUCT SERVICE TRAINING II-7
Case Study —Computer Company Training II-8
Case Study — Auto Mechanics Training II-9
Observations II-10
Projections for Interactive Videodisc in Product Service Training Applications II-10

D. PRODUCT MARKETING TRAINING II-13
Case Study — Automotive Marketing Training II-13
Case Study — Avon Products II-14
Observations II-15
Projections for Interactive Videodisc in Product Marketing Training Applications II-16

E. OPERATIONS/APPLICATIONS TRAINING II-17
Interactive Videodisc and Equipment Operations Training II-17
Case Study — Computer Company Training of Customers II-18
Observations II-19
Projections for Interactive Videodisc in Equipment Operations Training II-20
Interactive Videodisc and Employee Procedures Training II-21
Case Study — Bank of America's Interactive Videodisc Teller Training Program II-21
Observations II-22
The Future of Interactive Disc in Employee Procedures Training II-24

F. GENERIC TRAINING II-26
The Potential for Interactive Videodisc in Generic Training II-27

G. THE TRAINING MARKET FOR INTERACTIVE VIDEODISC — SUMMARY II-28
Marketwide Projections II-29

CHAPTER 3 - MARKETING AND MERCHANDISING III-1

A. INTERACTIVE VIDEODISC IN POINT-OF-SALE PROMOTION III-1
The Broader Market III-1
Current POS Applications III-2
Case Study — General Motors — Retail Auto Sales III-2
Case Study — Retail Sales of Personal Computers III-3
Observations III-4
The Potential Market for Interactive Videodisc in POS Applications III-5

B. INTERACTIVE VIDEODISC IN SUPPORT OF SALES III-6
Case Study — Mainframe Computer Industrial Sales III-6
The Future of Interactive Videodisc in Support of Sales III-7

C. VIDEODISC CATALOGS III-8
The Broader Market for Catalogs III-9
Case Study — Sears III-9
Case Study — American Express Travel Discs III-10
Transactional Catalogs III-10
Case Study — Stock Photo Agencies III-11
Case Study — Hotel Convention Catalogs III-11
Observations III-12
Projections for Interactive Videodisc Cataloging III-12

CHAPTER 4 - THE EDUCATIONAL MARKET IV-1

A. THE BROADER EDUCATIONAL MARKET FOR MEDIATED MATERIALS IV-1

B. THE CURRENT STATE OF INTERACTIVE VIDEODISC IN THE EDUCATIONAL MARKET IV-2

Case Study — The CPB/Annenberg Interactive Videodisc Science Instruction Project IV-3
Case Study — SPACE DISC IV-3
Observations IV-4

C. VIDEODISC AND PERSONAL COMPUTERS IN THE EDUCATIONAL MARKET IV-7

D. THE DEVELOPMENT OF THE EDUCATIONAL MARKET FOR INTERACTIVE VIDEODISC IV-7

CHAPTER 5 - THE ENTERTAINMENT MARKET V-1

A. THE BROADER MARKET FOR ENTERTAINMENT V-1

B. THE FUTURE OF VIDEODISC IN THE ENTERTAINMENT MARKET V-3
Factors Influencing the Growth of Linear Videodisc V-3
The Introduction of Interactive Videodisc Games V-4

C. GROWTH OF THE ENTERTAINMENT MARKET FOR VIDEODISC V-5

CHAPTER 6 - THE PUBLISHING MARKET VI-1

A. THE BROADER PUBLISHING MARKET VI-1

B. THE STATUS OF VIDEODISC IN THE PUBLISHING MARKET VI-2
Case Study — Houghton Mifflin Company VI-2
Observations VI-3

C. ARCHIVING APPLICATIONS FOR INTERACTIVE VIDEODISC VI-4

D. PROJECTIONS OF VIDEODISC PRODUCTION BY AND FOR PUBLISHERS VI-5

CHAPTER 7 - THE INTERACTIVE VIDEODISC INDUSTRY: PRESENT AND FUTURE VII-1

A. THE VIDEODISC PRODUCTION INDUSTRY: ORGANIZATION AND REVENUES VII-2
Industry Organization VII-2
Interactive Videodisc Industry Revenues VII-3
Patterns of Business Development VII-5
The Design, Production, and Premastering Process VII-7
The Economics of Design, Production, and Premastering VII-9

B. THE NEXT GENERATION OF THE VIDEODISC INDUSTRY VII-11
Premastering, Mastering, and Manufacturing Costs VII-11
Development of Computer Assisted Disc Authoring and Design VII-13
Interactive Disc Designers and Producers VII-13
The Volume of Commissioned Interactive Videodisc VII-15
The Increasing Installed Base VII-15
Financing to Meet Industry's Capital Needs VII-16
Competing Media VII-16

C. CHANGING PRODUCTION ECONOMICS VII-16

CHAPTER 8 - STRATEGIC OPPORTUNITIES VIII-1

A. FACTORS USED TO IDENTIFY OPPORTUNITIES VIII-1

B. MARKETS WITH LIMITED OPPORTUNITIES FOR PTV VIII-2
The Entertainment Industry VIII-2
The Publishing Market VIII-4
The Marketing and Merchandising Market VIII-6

C. BUSINESS OPPORTUNITIES FOR PTV VIII-7
The Education Market VIII-7
The Training Market VIII-9
Summary VIII-10

D. INTERACTIVE VIDEODISC PRODUCTION AND PUBLIC BROADCASTING VIII-11
Mastering and Manufacturing VIII-12
Conceptualization and Design VIII-13
Video Production and Premastering VIII-17
Summary VIII-21

E. STRATEGIC OPPORTUNITIES FOR PUBLIC BROADCASTING IN VIDEODISC PRODUCTION VIII-22
Implications for Public Broadcasting VIII-23

APPENDIX I - GOVERNMENT TRAINING EXPENDITURES

Preface

From the inception of the public broadcasting system, its nature and mission have been the subject of continuing debate both within and outside of the broadcasting industry. The purpose of this report is not to contribute to that debate, but rather to assess new opportunities for public broadcasting's continued survival within the context of furthering its mission. In evaluating possible roles for public broadcasting in the interactive videodisc industry, each must be judged in terms of the mission of public broadcasting.

For purposes of this investigation public broadcasting's mission is defined broadly, in order to open as many opportunities to consideration as possible and to engender the widest possible discussion of alternative postures vis-a-vis the interactive videodisc industry. This approach is suggested in a statement by CPB President Edward J. Pfister:

> Were one available, any alternative financing source must permit public broadcasting the freedom to create for the American people the kinds of educational, informational, and cultural services which would not otherwise find their way through commercial enterprise to the viewer and listener. Public broadcasting was created and is supported for the unique purposes of providing the different, the new, the risky, the educational.

This statement provides an apt rationale for public broadcasting involvement in the future of interactive videodisc technology and applications. No other medium fits so well the description of being different, new, risky, and educational. It seems quite appropriate, then, for the non-commercial broadcasting community to develop the skills and contribute the resources needed to further this unique medium. In large part, much of the groundwork for involvement has been laid — by the Nebraska Videodisc Design/Production Group and the efforts of individual public stations.

INTRODUCTION

In late 1982, the Corporation for Public Broadcasting (CPB) commissioned Butterfield Communications Group (BCG) to determine the potential for involvement by public broadcasting stations in the developing interactive videodisc industry and to develop strategies for participation in that industry.

BCG's task was to report to the Corporation on the existing state of development of interactive videodisc technology and applications, to assess the current and future markets for both interactive videodiscs and appropriate services which public broadcasting might render to the interactive videodisc industry, and to recommend an approach public broadcasting might implement toward participation in that industry.

BCG's approach was as follows:

- First, consultants visited the Nebraska Videodisc Design and Production Group's (VDPG) interactive videodisc facility in Lincoln and met with videodisc designers, developers, and users there and elsewhere in the country. The object of these visits and interviews was to understand fully the current state of development of interactive videodiscs, the historic and likely future commitment of resources to the development of interactive videodisc technology, and the capacity of videodiscs to serve a variety of needs currently met by other media.

- Second, BCG consultants surveyed virtually all markets expected to be served by interactive videodiscs through 1990, in order to understand growth trends in these markets and the extent to which interactive videodiscs might displace other media within each of these markets.

- Third, BCG consultants examined the existing videodisc design and production industry and, on the basis of the most likely markets and the consulting team's experience in the development of other media-based industries, forecasted the likely structural evolution of the interactive videodisc industry over the next 3 to 5 years.

- Fourth, BCG consultants interviewed key administrative and production personnel at nine public broadcasting stations to learn about the resources those and other stations might bring to bear in serving videodisc users and the design, production, and premastering segments of the videodisc industry.

Summary Of Findings

The basic technology necessary to make and use interactive videodiscs is, in large part, fully developed and tested. Several hundred thousand videodisc players are in the field, and many are capable of high-level interactivity when linked to a microcomputer. Technical issues currently under further development are directed at specific applications, for example, increasing the speed of program segment location by videodisc players to facilitate the use of interactive videodiscs in videogames, or developing authoring software to facilitate the translation of linear educational material into an interactive videodisc format.

Five primary markets for interactive videodisc can be identified, grouped around applications of the technology: training, merchandising and marketing, education, entertainment, and publishing. In general, the simpler, more apparent, and more valuable applications of interactive videodiscs are those which have been already brought to market and are most developed, for example, the use of videodisc displays for point-of-sale promotion and the use of interactive videodiscs to train automotive and computer service technicians. The more difficult applications of videodiscs, and those which represent less economic advantage over alternative media, remain in developmental stages. The most obvious such application is the use of videodiscs as a programming medium for videogames.

Only the training and marketing applications, for several reasons, have generated significant markets for interactive videodisc. The vast majority of current interactive videodisc users are in industry and government rather than the consumer market. The development, design, and production of interactive videodisc programming remains a very expensive process. The installed base of videodisc players with interactive capabilities across all markets is too small to assure an acceptable return on investment for independently produced interactive programs. Thus most interactive videodiscs produced to date have been either funded through foundation research grants, or commissioned by industry or government to perform specific tasks.

Consumers represent a significant portion of the future market for interactive videodiscs. However, high penetration of players in the consumer market will depend on the introduction of unique software products available only on videodisc. Such products are likely to include interactive video games, replacing current computer-graphics-based video games such as those offered by Mattel and Atari. Interactive disc games are beginning to appear in amusement arcades now and are expected reach the home market in three to four years. The development of a mass consumer market for videodiscs will most likely occur after 1987.

The videodisc industry is currently in the very early stages of development. Apart from a handful of self-produced discs turned out by in-house production centers maintained by large corporations (e.g. McDonnell Douglas and Hughes Aerospace Corp.), the majority of interactive videodiscs have been produced under commission by independent full-service production houses, with staff or subcontractors able to handle disc conceptualization, design, production, and post-production tasks. This industry structure is typical of early development stages in industries dependent on a variety of technical and artistic skills, for example, the television production and computerized animation businesses. The specializations developing in the interactive videodisc industry have centered on particular customers and needs and/or the general origins and interests of firms developing and producing videodiscs. For example, Sandy Corporation has done the great majority of its business with General Motors. The Glyn Group, which began as a commercial film maker, serves clients seeking very high production values.

This diversity highlights the unusual set of tasks and skills involved in interactive videodisc design and production. Depending on the nature of the disc, the types of professionals necessary in the premanufacturing stage could include an expert on consumer games, a training expert, an expert on programmed instruction, video production professionals, and editing and audio specialists.

Public broadcasting, because of its long leadership role in educational and instructional television and video production, is well equipped to provide videodisc production services to both the training and educational markets. But because the educational market is unlikely to develop before the end of the decade, only training represents a viable market for commercial entry. Public broadcasting's close ties with local schools and colleges provides a source of educational design skills necessary to serve the training market. In addition, some stations have developed strong links with corporate sponsors which may serve as the basis for a videodisc marketing effort. Over the past several years a number of public stations have developed "enterprise" divisions which have successfully marketed other types of production services to the corporate and media communities. Finally, the public broadcast community has available, as the result of CPB's funding of the Nebraska Videodisc Center, a unique source of interactive videodisc experience and knowledge.

CHAPTER 1

VIDEODISC: DEFINITIONS AND HISTORY

A videodisc can be thought of as a record which plays back video images and sound. A single videodisc can be encoded to reproduce thousands of visual images with sound and played by machines that translate the encoded program information into standard television pictures. Virtually anything that can be displayed on a television set can be recorded on a videodisc: motion pictures or still-frame sequences, color or black-and-white images, text or graphics, and two channels of audio. The discs can be encoded in digital or analog formats or both, thereby enabling them to contain both imagery and computer programs for interactive playback.

When produced in large quantities, videodiscs are less expensive to reproduce than other program storage media, such as film or videotape. Their radial design permits rapid access to any program frame, unlike tape-based media which require wind-through to locate specific segments. They are a very compact means of storing enormous amounts of visual material (up to 54,000 video images per side), and they can be played continuously for long periods with no noticeable wear or degradation in playback quality.

While videodiscs are still viewed as an emerging technology, the idea is not new. The first crude disc system, Phonovision, was introduced briefly in the 1920s. Long a product in search of a market, videodisc's practical development has occurred over the last 20 years, and has accelerated dramatically since 1979. Evolution to its current state has involved extensive research by many companies and expenditures of hundreds of millions of dollars.

Videodisc has already established a strong industrial market, with personnel training and consumer retailing applications leading the way. Introduction of videodisc entertainment products to the consumer market appears to be growing more slowly, but some analysts feel that disc and player sales will grow to billions of dollars within the next 10 years. Since 1979, when domestic videodisc marketing began in earnest, approximately 10 million discs and over a half million players have been sold.

In its movement from laboratory curiosity to applied technology, videodisc has emerged as a product with too many advantages to be ignored. The initial developmental interest in videodisc was not stimulated by its interactive potential; but since that potential was recognized, videodisc research and development of videodiscs has been oriented towards exploiting it. It is in the realm of interactive video that videodisc offers the clearest advantages over competing media. Many believe that the survival of videodisc hinges on the industry's ability to develop it as an interactive medium.

Definitions

To gain a clearer understanding of the morass of hardware and software technologies and applications generally called videodisc, the following terms should be kept in mind:

- **Videodisc** is a medium for the storage and retrieval of video images and audio signals.
- **Video** is an electronically generated visual image or display, including text, graphics, and visual images reproduced from film or videotape.
- **Videodisc player** is the mechanical device used to access and play back videodisc programming.
- **Interactivity** is defined as alternation of effort. In the context of this report, such alternation of effort refers to the interaction between user and machine. Very simply, interactivity means that a computer or microprocessor tells the disc player to do what the user wants: search for a new frame, overlay new text on the image being displayed, etc.

A. OVERVIEW OF VIDEODISC SYSTEMS

Videodisc systems can best be understood in terms of the capabilities of players and the design formats of the discs.

Videodisc Player Capabilities

Players may be divided into two groups according to their capabilities: linear and interactive. Linear players are intended primarily for continuous, start-to-finish playback of programming, such as movies, and little else. They can be enhanced by control options such as freeze-frame, segment or chapter viewing, frame-to-frame viewing, slow motion, fast forward/reverse search, dual-track stereo sound, remote control, etc. In any case, linear players only allow users to access videodisc programming in a linear fashion, in much the same manner as video and audio tape players.

An interactive videodisc player may incorporate an on-board microprocessor programmed to respond to user commands, or a player may be interfaced with an outboard computer to achieve the same results. An outboard computer allows the use of computer-generated graphic overlays of the video display and more sophisticated programming for interactive processes. Interactive programming may be digitally encoded on the videodisc or stored in a computer cassette, floppy disc, or other medium. An interactive player processes user commands or responses and then automatically plays back pre-programmed material corresponding to the command. Interactive players can combine the same variety of control options as linear players, but in addition they allow for pre-programming the use of these functions. This combination of sophisticated control functions and programmability is the crux of interactive videodisc.

Interactive players are categorized by levels according to their interactive capabilities:

- Level 1: A player with little memory and no processing power, permitting basic command-response interactivity.
- Level 2: A player with a small amount of memory and some programmability and processing power, permitting more sophisticated interactive command-response applications.
- Level 3: A Level 1 or 2 player interfaced with a personal computer providing increased memory and data processing power for even greater interactive capabilities.
- Level 4: A Level 3 player with sophisticated program-specific interface, including touch-sensitive display, voice-controlled activation, custom keypad, etc.
- Level 5: A Level 3 or 4 player as an element of a videodisc-based multi-point transactional network with all locations coordinated through computer-programmed control.

Videodisc player technology has evolved a second generation of capability — players specifically designed to be peripheral components of on-line computer systems. The prospective marriage of disc players and personal computers has industry analysts predicting that the disc player will be the most important computer peripheral by 1985. This forecast centers on three major factors: all videodisc formats can be produced in interactive form (with varying degrees of difficulty), videodiscs can store enormous amounts of digital data, and pirating videodisc programming is too costly and difficult to be profitable.

Videodisc Design Formats

There are two different types of videodisc formats available on today's market: the optical-encoded laser disc, and the capacitance electronic disc (CED). A third entry, the video high-density (VHD) disc, features yet another format variation, but its Japanese developers have delayed its official market release. Until its formal release, VHD poses no serious market threat to the other two formats.

While all three designs have basic operational similarities, they are incompatible. They differ not only in the pickup technique used to read the discs, but also in the way information is encoded and tracked on the discs.

Of the two currently available videodisc formats, the optical laser type has both linear and interactive programming capabilities, while the CED type is used primarily for linear playback, although an interactive version is under development.

Optical Laser Disc Format

Optical disc technology has developed two entirely different disc systems: the optical digital disc and the optical videodisc. Although this report focuses on the latter type of disc, a brief description of the digital type is warranted for purposes of clarification and differentiation between the two.

The optical digital disc is designed to store large quantities of data in digital, or bit, form. Information on the disc is represented in terms of numerically precise bursts of voltage. It is intended primarily as a mass storage device for computer memories. One variety of digital disc, termed "direct-read-after-write" (DRAW), produces one disc during the "write" function, but it is not mastered or replicated. This DRAW technology has been used as the basis of an office information center recently brought to market by Matsushita. Most applications of digital disc technology are still in development, however, and will have little impact on the videodisc marketplace for some years.

The optical videodisc is used primarily to record and store video images and audio signals in analog form, that is, as constant voltage representations of physical-quantity data. However, some digital recording is also possible. Since many replications can be made from a single master disc, this system is particularly well-suited to the mass production and distribution of complex subject matter. The optical disc will be examined in greater depth in the chapters which follow because of its potential impact on education, training, retailing, and storage and retrieval of artwork, photographs, maps and other visuals.

The optical pickup laser system, developed by Philips and MCA, was introduced to U.S. test markets in 1978 and became available nationally in 1980. Optical videodisc development has resulted in two types of discs: reflective and transmissive. Both types carry information etched by a laser in the form of microscopic pits. The pits are arranged on the disc in a concentric circular pattern, with each track containing encoded information pertaining to one video frame.

Reflective discs are similar in appearance to conventional audio recording discs. Encoded program material is etched on the face of a disc. Next, a highly reflective metal-based coating is applied to the etched side. Two such discs are then bonded together back-to-back. Finally, the entire assembly is coated with clear plastic for protection. The result is a disc which resembles a shiny silver audio record. During playback, an optical laser within the videodisc player scans the disc. The light is transmitted and read from the same side of the disc, and read according to variations in the light reflected from the etched signal tracks. The reflected light is then translated by the player into electrical signals which produce visual images and audio that are compatible with standard television monitors.

Transmissive discs, developed and marketed primarily by Thomson CSF, are made of transparent plastic. Like reflective discs, encoded program material is etched on one side of a disc. During assembly, two discs are bonded face-to-face (leaving a narrow space between faces) for protection. During playback, laser light transmitted from one side of the disc passes through the disc, focusing on the etched programming material, and is read on the other side where it is decoded for video display. Transmissive discs are easier and less expensive to reproduce than reflective discs since they do not require a reflective coating, and by simple adjustment which refocuses the laser reader, both sides of the disc can be played back without turning it over.

The optical laser system is generally regarded as a more sophisticated design format than CED, and most analysts agree that it is more versatile and has more potential uses. Several interactive disc programs have been produced by the LaserVision group (MCA/OPA/Pioneer/Magnavox) since early 1982. Among disadvantages noted in laser system technology are the complicated and expensive optics involved and the helium-neon laser with its limited life, high-voltage power needs, size, and cost.

Optical videodiscs are available in two playback modes differentiated according to the amount of disc space required per frame of video/audio information, and the speed at which the disc's signal tracks must pass the optical reader for proper playback.

Constant Angular Velocity (CAV) discs contain the same number of etched signal pits on each track. The number of pits per track is such that images produced from outer tracks visually complement images produced from smaller inner tracks. Because of this arrangement, CAV discs lend themselves to interactive programming.

Constant Linear Velocity (CLV) discs are designed for replay of linear programming, such as movies, and rotate at constant speed during playback. The arrangement, or sequential spacing, of etched signal pits on each track is uniform throughout the disc. CLV discs permit two hours of real-time programming (60 minutes per side).

Combination CAV/CLV discs feature interactive programming on one side and linear programming on the other, enhancing their range of applications.

Capacitance Electronic Disc (CED)

Developed by RCA Labs and introduced to the U.S. market in 1981, CED incorporates grooved signal tracks cut into the disc surface, which is protected from damage by a plastic sleeve, or caddy. A diamond and metal stylus is used to sense the disc tracks in much the same way a phonograph needle tracks a record groove. The stylus reads encoded information from the disc for translation into electrical impulses which energize a television screen.

CED discs are also available in interactive form. However, because of their spiral groove format, rapid location of specific programming poses special problems. Linear search time has been reduced through consecutive duplication of individual frames, enabling the stylus to more quickly locate a bracket of identical frames as opposed to a single frame.

Video High-Density (VHD) Disc

Although the VHD disc is not currently available, it is useful to note that its format is a variation of the CED format. In principal, the VHD player uses a floating diamond stylus to read digital signals pressed onto the sensitized disc surface. The path of the stylus is aided by a metal shoe guided by programming signals on the disc surface.

Differences in videodisc formats represent the very difficult decisions developers and manufacturers have had to make in defining their systems. At the same time, the incompatibility among systems reflects the intense competition between manufacturers, and the absence to date of marketplace forces which might encourage greater standardization and interchangeability.

B. HISTORICAL BACKGROUND OF THE INDUSTRY

Optical disc recording was conceived as early as 100 years ago by Alexander Graham Bell. In the 1920s Phonovision made its brief appearance, and in the 1930s John Baird developed an early videodisc which reached the British market. But the development of videodisc technology remained largely dormant until the late 1950s. In 1958, Paul Gregg conceived his idea for an encoded video record played back using an optical reader. He later became associated with the 3M Company where he was involved in 3M's early videodisc development.

In the early 1960s, Gregg was instrumental in forming Gauss ElectroPhysics, primarily to attract funding for the development of videodisc technology. Gauss, which first developed a high-speed audio duplicator, approached General Electric, Magnavox, McDonnell-Douglas Electronics, and N.V. Philips of the Netherlands with proposals for their investment in videodisc development. An arrangement was reached with G.E., producing only tentative results through a demonstration system. In 1967, Gauss was acquired by MCA, which had been assessing videodisc potential with obvious interest for some time. The acquisition signaled Gregg's departure and moved MCA toward its first public demonstration of MCA DiscoVision players in December 1972.

Paul Gregg has since remained in the mainstream of videodisc evolution, most recently with Videodisc Technology Corporation, which in 1982 patented a new yet simple process of making low-cost high-yield laser video and audio discs.

Meanwhile, a parallel scenario was taking shape. In 1961, 3M contracted SRI International to research and develop videodiscs. Under the direction of Dr. Philip Rice, SRI produced an optically recorded and read videodisc in October 1962. By mid-1963, several playable discs were developed containing motion and still images without sound. It is generally accepted that Rice's work at SRI resulted in the world's first optical videodisc.

In terms of scientific conceptualization, John Dove was perhaps the first to articulate ideas for optical recording with laser beams, preceding Gregg and Rice by several years in this respect. A civilian working on optical memory technology under a U.S. Air Force contract, Dove was authorized by the government in 1962 to seek patents on his concepts, since little practical use could be foreseen for recording and reading data by optical means. Several of his ideas were later employed by DiscoVision Associates prior to its withdrawl from videodisc production.

While scores of others have justifiable claims of pioneering videodisc concepts, few, if any, have successfully applied their thinking from a business or economic standpoint.

In addition to individuals, a number of small companies, like Gauss ElectroPhysics, were formed to explore a variety of read-only optical disc concepts. From SRI's "first disc" breakthrough, 3M created I/O Metrics, whose principals later formed ARDEV with Atlantic-Richfield and later sold it to McDonnell-Douglas. All of these firms pursued relatively the same developmental course for videodiscs, bringing the technology closer to fruition though falling short of rousing consumer interest.

The brief history of videodiscs seems to indicate that large major corporations have a better chance of succeeding in an industry where individuals and small companies have failed. If for no other reason, large corporations have the financial resources to bear the massive costs associated with product research and development and business start-up. By contrast, however, larger firms are less pressured, and therefore slower to move products to market against a declining entry window.

Most of the attention in videodisc development has focused on the activities of large companies. MCA has been in the videodisc business for over 15 years. Philips' involvement has been almost as extensive, preceding its acquisition of Magnavox by several years. Pioneer's long-term approach toward optical laser disc technology has brought the company through a web of liaisons with Philips, MCA and IBM (DiscoVision Associates) to its current lead position in the videodisc market. Long before agreeing to manufacture DiscoVision players, Pioneer turned out its own machines for research evaluation. Extensive internal research and development efforts by Sony Corporation date back to the early 1970s.

Non-optical disc technologies had their first public demonstration in 1970 and emerged on the market in 1975 through the joint venture of West Germany's Telefunken and Britain's Decca, which introduced the short lived TeleDec mechanical disc format. The system employed a pressure-sensitive pickup to read encoded discs, but was dropped from the market shortly after its release.

A serious effort was initiated at RCA Laboratories in the mid-1960s to create a unique videodisc system design that would retain advantages similar to those of audio disc recordings and provide a new mechanism for home entertainment and education. Essential features of the new design approach included low-cost discs and players, state-of-the-art picture and sound qualities, and long playing time — or much the same characteristics sought earlier by optical disc developers.

A pressure-sensitive pick-up employing an extremely small stylus tip was considered by RCA as early as 1964 (and later produced by Telefunken/Decca), but discarded due to overly-sophisticated and costly manufacturing requirements. Optical pick-up techniques were considered as well, but also ruled out for reasons of cost and complexity. RCA finally settled on the capacitance pick-up system and by 1968 resolved to develop and produce a grooved 12-inch disc coated with thin conducting and insulating coatings and mastered electron beam.

By April 1971, RCA had an electron beam recorder and began testing the CED mastering techniques. By 1974, repeated difficulties with this process led to its replacement by electromechanical (EM) recording, which RCA had been testing on a smaller scale since 1970. Despite numerous setbacks, EM recording finally emerged as RCA's preferred technique late in 1976. During the remainder of that year some 240,000 experimental discs were pressed.

At the same time, 25 RCA disc systems were privately field tested. The tests revealed the discs were vulnerable to household dust and scratching through normal handling. Hence came the rigid protective videodisc sleeve, or caddy. Additionally, in January 1977 RCA found that pressing discs from a conductive compound was cheaper and superior to the more complex injection molding/multiple-coating process used earlier. RCA introduced its system to the U.S. market in 1981.

By 1980, RCA had combined efforts with Zenith Radio Corporation and CBS, Inc., to produce grooved CED videodisc systems and appeared to have taken the early lead in establishing its SelectaVision technology as the retail standard. In close pursuit was Japan's Matsushita Electric Industrial Company, the world's largest consumer electronics firm, with its National, Panasonic, and Quasar brands. Matsushita adopted the CED format developed by its subsidiary, Japan Victor Company (JVC), and enlisted General Electric and Britain's Thorn EMI Ltd. in its venture, which has thus far stumbled enroute to market. As recently as April 1983, however, Matsushita unveiled its design for an optical direct-read-after-write (DRAW) system, which features erasable/recordable technology and will be sold initially in the office automation systems market.

Numerous domestic and foreign companies have entered and exited the videodisc industry over the past few years, leaving behind them a wake of approaches to the consumer, educational, and industrial videodisc markets. Staking out roles in system design, programming development, manufacturing, and marketing, they initially succeeded in identifying potential institutional videodisc applications rather than in appealing to the individual home user. Of late, the issue of interactivity has stirred considerable interest and speculation that it will have mass-market appeal. The intense jockeying for position within the industry by the major companies mentioned above provides some insight into their assessment of the business potential of videodisc.

In addition to the private sector, government has played a major role in stimulating videodisc development. Most noteworthy involvements include the Hughes Corporation's videodisc-based industrial maintenance and repair process (TMIS), commissioned by the U.S. Air Force, the Department of Commerce's sponsorship of the 1982 World Fair's U.S. Pavilion disc project, and the Library of Congress' sponsorship of videodisc archiving activities.

The scope of established, ongoing videodisc applications, while still quite limited, is developing quickly and producing positive results. Areas of primary activity are in-home entertainment, composed largely of movies; commercial and industrial training; marketing and merchandising; education; and publishing. Specific industries, led by the automobile and retail computer industries, have emerged as early leaders with substantial commitment to videodisc applications for employee training and point-of-sale efforts. Each of the videodisc market segments has been impacted by the introduction of interactive capabilities, and present indicators point to an extension of this trend. The industry's prospects for survival and growth in the consumer market depend on whether videodiscs and players become the hot consumer product of the 1980s (consumer discs now cost about $20 each, and players range anywhere from $250 to $1,000 each) or merely a peripheral part of a marketplace already crowded with home entertainment items.

C. THE STRUCTURE OF ANALYSIS ADOPTED FOR THIS REPORT

In analyzing the current and likely future market for interactive videodisc, BCG has adopted a "market share" approach. Because interactive videodisc is essentially a medium for the storage and retrieval of images and sound, it belongs to a broad class of products commonly called "mediated materials." The potential market for interactive videodisc, therefore, lies somewhere within the larger market for mediated materials, which amounted to about $38 billion in 1982. Projections indicate that the total market could reach the $100 billion level by 1990.

Mediated materials are used in a number of distinct applications, defined according to principal market segments. Chapters 2 through 6 focus on each of the segments in terms of historical growth, present size, and likely future growth, with special emphasis on the potential each segment holds for interactive videodisc applications. Factors likely to influence the success of interactive videodiscs in these applications are identified and evaluated. Additionally, Chapters 2 through 6 project the share of software expenditures in each market segment that interactive videodisc has the potential to capture. Case studies are used to provide insights into decision and implementation processes for each application.

Behind this "market share" approach lies the assumption that interactive videodisc will create little new spending, subsisting instead on revenues diverted from other media and supplanted human resources, such as teachers, training instructors, and others. Although interactive videodisc is clearly a new technology that offers new and different ways of performing various tasks, many of the tasks for which it seems particularly suited have been performed in the past and are being performed now by other media and specialized personnel. The success of interactive videodisc will depend upon its ability to compete as an alternative medium, and the revenues it produces will be revenues displaced from other media and personnel. There are, however, exceptions to this assumption — instances in which videodisc offers a means of performing a new task, such as the military videodisc mapping project under development at MIT.

Because it is unlikely that the public broadcasting community has the desire or potential to enter the videodisc hardware business, the focus of this report is on interactive videodisc software. The market for mediated materials is a software market. Therefore, the analyses which follow examine the software side of the various industries considered. For instance, sales of records and tapes are considered, while sales of phonographs and tape decks are not; sales of books and audiovisual materials to educational institutions are considered, while sales of slide and filmstrip projectors are not. Hardware expenditures are considered only insofar as they provide insights to the size or dynamics of the software market, or when isolating software expenditures is not otherwise possible. The focus on software, aside from conforming to the skills and resources of public broadcasting, is particularly appropriate when projecting the success of a new technology like interactive videodisc. For interactive videodisc software demand and availability will drive the hardware market; or, in other words, consumers, companies, and institutions will buy videodisc players only when they provide access to desirable videodisc software.

Chapter 7 provides an analysis of the current structure of the videodisc industry based on extensive interviewing with industry participants as well as basic research. Chapter 8 contains recommendations based on the findings and analyses of this report for consideration by CPB in its strategic approach to involvement in the videodisc industry.

CHAPTER 2

TRAINING

To date, training applications (industry and government education of employees) have provided the largest market for interactive videodisc. In fact, interactive videodisc is already a mature training medium in certain industries. The automobile and computer industries are prime examples, with installed bases of interactive players, annual budgets for software production, established procedures for decision-making and implementation, and extensive use of interactive disc technology to accomplish a variety of tasks. Over the next 4-5 years, training applications will continue to offer the largest potential market for interactive disc.

Training applications developed as the first market for interactive disc for several key reasons:

- Training takes place in a **controlled environment**. Unlike consumer-oriented interactive videodisc applications, training does not rely on widespread individual acceptance of a new medium and the slow development of an installed base of players. Implementation of videodisc-based training is typically a corporate decision which at one stroke creates both a software market and an installed player base. It is worth noting that such controlled environments also triggered decisions which established the initial market acceptance of other new technologies, such as computers and videocassette recorders.

- **Analogies** to videodisc-based training already exist. Both industry and government are experienced users of standardized training methods, such as programmed texts, computer assisted education (CAE), and computer assisted training (CAT). Both use video extensively as a training aid, and thus have established liaisons in video design and production. Large government agencies, like the U.S. Postal Service, and many corporations have in-house video production departments to support training, marketing, and other communications efforts.

- Throughout the technology's development, training was consistently cited as its **most apparent application**, accounting for the early interest and growth in videodisc-based training applications.

- Finally, the rapid growth of technology in the workplace, coupled with demands for increased productivity, fuel **the demand for training**. The cost-effectiveness of interactive video disc-based training has attracted large-scale government and private sector users.

A. THE TRAINING MARKET FOR MEDIATED MATERIALS

"Training" is defined here as industry and government sponsored employee education. It includes teaching specific job-related tasks, educating management personnel in human relations skills, acquainting salespeople with new product lines, and countless other educational tasks. What identifies a given educational experience as training is that it is paid for by the employer.

While the training "industry" and the training market continue to attract increasing attention and analysis, there is relatively little solid information on the size of the market. Estimates of total spending vary widely. Various sources estimate total industry and government spending for employee training in 1981 at between $15 billion and $120 billion. In a study of computer-based training, TALMIS Inc., a non-profit research corporation in Oak Park, Illinois, estimated total U.S. training expenditures in 1981 of $17.5 billion (including costs of training personnel, administration, salary replacements, etc.). Major difficulties in determining the size of the training market include the lack of a precise definition of training and a lack of consistency in available data as to what costs are considered "training expenditures." There is, however, one point concerning training on which there is a general concensus: the training market is large and growing rapidly.

The growth of the training market can be attributed to a number of broad trends affecting both industry and government. The last decade saw an explosion of technology, much of it microprocessor-based, aimed at relieving workers of relatively mechanical workplace tasks. Workers had to be trained to build, service, and operate this technology. Many American industries found themselves in an era of increasing competition with their foreign counterparts, which increased emphasis on production and, in turn, created demand for cost-effective technical skills training. The continuing shift of American industry from a manufacturing orientation to a service orientation has created the need to retrain displaced workers. The need for training in the military has increased because of the lower educational levels of new recruits. Other government agencies confront similar problems. All these trends have resulted in a growing demand for training and an active search for more effective, lower-cost training methods.

BCG research identified $33 billion in industry and government training expenditures in 1982. This figure includes spending for training hardware and software, as well as the costs of trainer salaries and trainer salary replacement. Because videodisc is a medium for the delivery of courseware, the videodisc share of the training market is part of training software expenditures, which reached $6 billion in 1982. BCG expects this figure to reach $20 billion by 1990.

Because data on training expenditures are often not available through standard industry or government reporting, total 1982 training expeditures may have been nearly twice as much. Indeed, $60 billion is more in line with industry estimates and is by no means implausible. At that level of total expeditures, the software component approaches $10 billion in 1982 and could well exceed $33 billion by 1990.

The sections that follow discuss the broad market for training software in more detail. Industry and government spending are examined separately.

Industry Spending for Training Software

Training magazine, in a study of U.S. industry training, estimated 1982 budgeted external expenditures for training software to be approximately $2.3 billion. This total was divided among three primary types of training software, as indicated in the following table.

Budgeted External Expenditures for Training Software

Training Type	Millions of Dollars* — Projected					
	1982	1984	1986	1988	1990	Annual Growth
Off-the-Shelf	$680	$1102	$1786	$2895	$4693	27.3%
Percent of Total	30.2	33.6	37.1	40.6	44.1	
Custom-Design	$541	$828	$1267	$1939	$2968	23.7%
Percent of Total	24.0	25.3	26.3	27.2	27.9	
Outside Services	$1032	$1347	$1757	$2293	$2992	14.2%
Percent of Total	45.8	41.1	36.5	32.2	28.1	
Total	$2253	$3277	$4810	$7127	$10,653	21.4

*All dollar amounts are in current dollars and reflect an inflation rate of 10%.

Source: BCG projections based on historic data from varied industry sources.

Off-the-shelf expenditures include spending for films, books, pre-packaged workshops, etc. Custom-design expenditures are for custom-produced training materials such as audiovisual productions and workshops or seminars tailored to the specifications of a given company. Outside services include public seminars and training consultants' fees.

Growth rates for expenditures in each of these categories are based on BCG analysis of historic trends. Annual growth of better than 21% is anticipated, resulting in a software market approaching $5 billion in 1986 and exceeding $10 billion in 1990. Particularly significant is the shift of budgeted expenditures away from outside services and toward off-the-shelf materials. In 1982, off-the-shelf materials accounted for about 30.2% of training software expenditures, but are expected to make up 44% by 1990. Economics largely explain this shift; hiring outside consultants to design a training program is almost invariably the most expensive option open to managers. Some of the recent and anticipated growth in the training market is due to an increasing number of smaller concerns initiating training programs. Particularly in their case, using off-the-shelf materials is the only affordable alternative.

Software expenditures, though the primary focus of this analysis, make up a relatively small proportion of overall training costs. The U.S. Civil Service estimates that software expenditures comprise only 25% of government training costs (excluding hardware and trainee salaries). Applying this ratio to the $2.3 billion in 1982 software expenditures budgeted by industry, then adding hardware costs and a very conservative estimate of the costs of trainee salary replacement, brings total spending to approximately $17 billion.

This estimate probably falls below what industry actually spent for training because the census data on which it is based miss significant portions of training expenditures. An important area not included in the estimate involves the costs of equipment operation and maintenance training provided by equipment manufacturers to their customers, such as the training business machine companies offer to the clerical staffs of large buyers of office automation equipment. Such training expenditures are bundled with the purchase price of the equipment and are, therefore, practically untraceable.

Government Spending for Training Software

Government reporting practices divide statistics on the training of government employees into four major areas: military personnel, U. S. Postal Service employees, Civil Service employees, and the employees of state and local governments. Available data on training expenditures in these areas indicates spending in excess of $16 billion, but actual spending was probably higher.

The following table projects government expenditures for training software through 1990.

Government Expenditures for Training Software — 1982-1990

Agency	Million of Dollars* — Projected					
	1982	1984	1986	1988	1990	Annual Growth
Department of Defense	$1660	$2400	$3310	$4550	$6270	18%
Postal Service	20	30	50	70	90	19%
Civil Service	90	110	120	140	160	8%
State & Local Government	410	480	550	640	730	8%
Total	$2180	$3020	$4030	$5400	$7250	16%

Sources: Standard Government statistical sources and BCG projections.

*All dollar amounts are in current dollars and reflect an inflation rate of 10%.

Although these figures are based on the data available from government agencies, they by no means account for all government spending for training software. The Department of Defense figures, for example, reflect spending for the training of individuals (e.g., recruit and officer training, specialized training, advanced training) but not for the training of operational mission units or crews. Moreover, only appropriations explicitly designated for training are included. (For a more detailed discussion of the individual components of government training, see Appendix 1, "Government Training.")

Despite this caveat, the spending reflected by the preceding table represents that portion of the government training market which holds the greatest potential for interactive videodisc applications. Training expenditures not reflected by the table include training unsuitable for videodisc presentation (e.g., training of operational mission units in the armed services) or for non-standardized training experiences (e.g., employee tuition reimbursement by local postmasters). The single major exception is spending for equipment maintenance and operations training. Both equipment manufacturers and the Department of Defense itself are investigating the feasibility of using interactive videodisc for this training task.

Government Spending for Non-personnel Training

In addition to the costs of training military and civil personnel, the U.S. Government spends large sums of training as a form of direct service provision. Some of this Federal non-personnel training falls under the heading of consumer/public service education, such as energy conservation programs. Some is intended to disseminate information or impart "soft" skills, such as the USDA Extension Service programs. Perhaps the best known of these government training programs is CETA, a "hard" training program designed to provide local level employment assistance and training to certain target populations.

Although the CETA program is federally funded, administration on the local level is the responsibility of designated "prime sponsors" who structure the local programs to serve the appropriate target population. Despite this emphasis on local control, however, CETA training in most localities involves a number of standard parts — for instance, coaching in job interview skills. These segments of the program represent likely candidates for nationally standardized instructional media — a function which could be filled by interactive videodisc. Other government non-personnel training programs are likely to offer similar opportunities for the use of videodisc.

Due to its nature, overall Federal spending on non-personnel training is difficult to estimate. But just the size of the CETA program indicates expenditures are extensive. Projected 1983 expenditures for training and administrative costs of the CETA program (not including payments to participants) are $1.41 billion. Federal spending for training and technical assistance not allocated to prime sponsors is expected to be $12.2 million in 1983. Reauthorizing legislation for 1984 has not been passed, but the Administration has requested only $5.9 million for the latter category. A portion of the training function now administered under CETA will in October 1983 come under a new $3.6 billion Job Training Partnership Act, designed specifically to train workers in the skills demanded by the jobs marketplace. The Administration has requested additional funding under this act for retraining displaced workers, raising the amount earmarked for this purpose from $25 million to $240 million.

Interest in interactive videodisc by various Federal departments, including DoD, the U.S. Postal Service, and the Library of Congress, is high, and may ultimately spread to non-personnel training efforts.

B. CURRENT TRAINING APPLICATIONS OF INTERACTIVE DISC

Interactive videodisc training has gained a firm foothold in certain segments of U.S. industry and government, and there are strong indications that it will become a standard training tool. Characteristics common to early users of videodisc training can be identified:

- **Large companies.** Pioneer efforts in videodisc training were typically undertaken by large organizations possessing a combination of characteristics: many employees to train, sizable established training or human resources development departments, large annual training budgets, and/or wide geographical disbursement of employees who needed training.

- **Large training task.** A number of factors created the substantial training need that accompanied early videodisc training: many people to train (many employees, or high turnover); and large amounts of information with a visual component (complicated product, large product line, rapidly changing products).
- **Technology-oriented companies.** Not only do such companies generally have complex products, but they are also generally comfortable with high-technology solutions to business problems. (The early use of videodisc training by automobile companies is an exception.

Companies or government agencies with these characteristics typically need standardized training materials that can be easily and widely distributed. Their motives for exploring interactive videodisc training vary and include an interest in finding more cost-effective training alternatives, determining the potential for multiple uses of interactive videodisc equipment (e.g., for marketing support), and turning their videodisc training experience into a profitable business segment.

In order to better examine the potential training market for interactive videodisc training, BCG has divided the market among four general types of training applications:

- **Product service** — training service technicians to repair and service equipment.
- **Product marketing** — sales force training.
- **Applications and operations** — training employees and customers to use equipment, and teaching job-related procedures to employees.
- **Generic training** — teaching general skills applicable across a broad spectrum of companies and industries, such as management or human relations skills.

The following sections examine each type of training application.

C. PRODUCT SERVICE TRAINING

Product service training involves training technicians to maintain and repair products. Often, the technicians are employees of the company which produced the product, as when IBM trains its own field technicians to service its mainframe computers. In other cases, product servicing is performed at great distances from the manufacturing company, yet the manufacturer bears some or all responsibility for training service personnel. For instance, Ford Motor Company provides training for its dealers' mechanics although they are technically employees of the dealers, who are Ford franchisees. In still other cases, a product's end user may be given product service training by the manufacturer. For instance, Boeing and Lockheed often must train airline and armed forces technicians to service their products.

The two case studies which follow, taken from BCG interviews of a major computer manufacturer and an American auto maker, illustrate the application of interactive videodisc technology in product service training.

Case Study — Computer Company Training of Field Service Employees

A major computer manufacturer interviewed by BCG adopted interactive videodisc training in response to a dramatically increasing field service representative training load coupled with increasing training costs. The company maintains a force of 12,000 service representatives worldwide. Though well paid, the service force is subject to a great deal of turnover due to the high demand for their skills. The company's price list includes 10,000 hardware, software, and service products, and 200 new products are added each year. Moreover, many existing products (particularly software) are periodically enhanced — thus altering the content of original training materials for that product. The company is also committed to supporting discontinued products. The proliferation of new products means that many new basic courses must be delivered to existing service representatives; and because of the high turnover rate, the company must continually train new representatives to maintain the existing product line.

The corporation has established approximately 30 regional training centers for both service and sales representatives. The center nearest to corporate headquarters is the most active, handling approximately 1000 trainees each week (the proportion of service vs. sales employees is unclear). The company has reduced lodging costs by purchasing apartment buildings near the training center for use as trainee dormitories. Nonetheless, training costs are about $3000 per employee per week. Annual training costs for all employees and courses exceed $100 million.

Field service training is usually a hands-on experience, so there was great initial skepticism about a videodisc-based course. The company performed a test of training methods for the repair of a computer terminal. A control group of trainees was given the traditional one-day course involving classroom lectures, workbooks, and hands-on laboratory time. The experimental group was provided with a 4-hour videodisc-based training program, which involved no direct contact with the actual computer terminal to be repaired. As a learning-effectiveness test, both groups were then given terminals to repair. The videodisc-trained group was as successful in this test as the conventionally-trained group.

The use of videodisc-based training of field service representatives is now firmly entrenched in the company's program, in part because the cost of training is charged back to the field service cost centers, where management is happy with the cost reductions. The company estimates that a minimum of 20 videodisc training programs are required to justify the investment in hardware and disc production and to make interactive disc more cost-effective than classroom training. Future plans involve placement of $15,000 videodisc-based learning consoles (consisting of a disc player interfaced with a personal computer and a color TV monitor) in all 30 field service branch offices. Because sales and administrative personnel also work at these locations, the use of videodiscs is being expanded to train these non-service employees as well.

The interviewee informed BCG that similar Fortune 200 companies are also likely to have $100 million annual training expenditures and that a Fortune 25 company could spend $1 billion annually on employee training of all types. From an economic perspective, there is reason to expect that videodisc-based training will spread to every major computer company. In addition, the interviewee expressed satisfaction with the quality of videodisc-based training and the positive response from employees to this type of training.

Case Study — Auto Manufacturer's Training of Dealership Mechanics

A major Detroit automobile manufacturer has 6,000 independent dealers. The corporation provides 800,000 man-hours of dealer mechanic training annually at its 38 corporate-sponsored training centers.

In 1981, it was calculated that 27% of the 800,000 man-hours were used to introduce mechanics to the basics of repairing new car models. This represents a significant increase over historical ratios due to marketing and engineering decisions which led to an expanded selection of new models and more new parts. In 1982, 54% of the total training man-hours were used to teach repair basics for new models and parts, and the ratio is expected to reach 70% by 1983.

In order to reduce training costs and enhance the quality of training, the company initiated a program to train mechanics via interactive videodisc learning centers, or kiosks, placed in the dealerships. The rationale for this step held that the use of videodisc-based training of mechanics on repair basics of new models would reduce the percentage of time being spent teaching repair basics and parts at the field training centers. Moreover, the company feels that videodiscs improve the quality of training and bring it closer to the relevant tasks by transferring the training activity from the corporate field centers to the individual dealerships.

Of the company's 6,000 franchised dealers, 4,700 are deemed to be candidates for videodisc kiosks, and 4,300 have joined the videodisc project. As a result, 70% of dealer mechanics have direct access to interactive videodisc training. The videodisc kiosk package costs the dealers $3000 (with leasing arrangements available), plus each dealer must subscribe to an entire year's output of discs related to his dealership (estimated in advance). The maximum number of discs a single dealer could receive in one year is 50. Twenty-five percent of the discs produced by the company are directed toward mechanic training. The rest are sales training and promotional discs. Due to the mix of different products handled by different dealers, the audience for some discs is as small as 800 dealers, while a "generic" disc would reach all 4,300 dealers who signed on.

The dealers' yearly subscription fees go into a central fund for disc production, and the manufacturer's marketing and mechanic training groups contend for their respective shares of the fund.

Present kiosks include simply a Level 2 player and a monitor. The company plans ultimately to replace these with a disc player coupled with an outboard computer, floppy disc drive, TV monitor, light pen, and a "sound over still" device. In addition to the more sophisticated training enabled by the additional equipment, the computer software will also collect data regarding each trainee's course performance. This system has already been installed at 27 test sites. Plans call for each dealership to have two of these more sophisticated configurations (one for mechanics and one for the sales floor), each connected to the dealership's central computer, which will also handle dealership accounting.

Observations

Both the computer and automobile companies have a large number of employees who need to receive the same information and be taught the same skills. And the entire group must be trained within a relatively short time in order to meet demand when new product models are introduced. Training manuals or computer assisted training could meet this requirement, but the need for realistic high-quality visuals that show a sequence of operations makes video more effective. Both companies had previously used training centers, but found this alternative too costly. Both cases also involve a dispersed service structure and significant end-user concern about the availability and quality of service.

Projections for Interactive Disc in Product Service Training Applications

The companies described in both cases above are industry leaders. The fact that each found clear evidence that interactive videodisc is a cost-effective and quality training mechanism should help establish a positive reputation for videodisc within the respective industries, thereby encouraging other companies with similar training needs to invest in the technology.

There are more than 20 computer companies which are prime candidates for videodisc-based training of their field service employees, including IBM, Digital, Burroughs, Control Data, Data General, American Bell, Honeywell, NCR, Sperry, Raytheon Datasystems, Amdahl, Northern Telecom, Prime, Wang, Hewlett-Packard, Datapoint, Perkin Elmor, Harris, Apollo, Tandem, ComputerVision, CompuGraphics, and Nixdorf. The following table presents projections of the likely growth of interactive videodisc training for field technicians in the computer industry and the disc production this growth will generate.

Product Service Training — Computer Companies

Year	Projected Disc Production		
	Companies Using Disc	Discs per Company	Disc Titles
1983	3	15	45
1984	5	17	85
1986	10	20	200
1988	15	20	300
1990	20	20	400

Source: BCG

Desktop computer manufacturers and smaller computer companies perform product service training through nationwide third-party service organizations, such as TRW, or depend on independent retail computer stores or computer chains, such as Computerland for servicing their products. The use of third-party service makes implementing interactive videodisc training difficult. It is not clear that third-party organizations are willing to bear the cost of videodisc hardware or, in the case of retailers, could afford the expense. Nor do microcomputer companies exercise quite the same leverage over their dealers as automobile manufacturers. Moreover, repairs of these small computers often involve simply replacing a circuit board or microchip, and thus do not require extensive training. For these reasons BCG does not foresee the development of significant interactive disc service training among small computer companies.

However, other manufacturers of electronic-based products, such as robotics, medical and laboratory instrumentation, communications, CAD/CAM, and computerized photocompositers, are likely candidates. Such products are less widespread than computers. Complexity, rather than large service forces, will drive the adoption of interactive videodisc training in these industries. The use of videodisc training will emerge and develop more slowly here than with computer companies.

BCG expects a significant increase in videodisc production activities for automotive service training. General Motors and Ford currently lead the field, and it is anticipated that the cost effectiveness of videodisc-based training, together with competitive pressures at the dealer level, will lead other auto manufacturers to participate as well.

Ford and General Motors are the only auto makers who have invested significantly in videodisc-based product service training to date. Together they produced about two-dozen discs for mechanic training in 1982. The level of production will likely double by 1990. More than a third of American Motors Corporation dealers also handle Ford and GM cars, and their exposure to the videodisc programs of the larger manufacturers is in part responsible for AMC's foray into interactive videodisc training in early 1982. BCG expects this sort of pressure produced by "dual dealerships" to lead other manufacturers into videodisc-based training.

Chrysler/Dodge/Plymouth, American Motors, Volkswagen, BMW, Porsche/Audi, Mercedes-Benz, Toyota, Datsun, Honda, Subaru, Mazda, Saab, Volvo, and Peugeot are candidates for videodisc-based service training. Because these dealers have smaller model lines than the company discussed in the case above and change their models less frequently, they are likely to produce fewer discs (perhaps 10 in the near future, with five devoted to product service training). As their reliance on interactive videodisc for training and other functions continues, these numbers should double.

Product Service Training — Auto Companies
(excluding Ford and GM)

Year	Projected Disc Production		
	Companies Using Disc	Discs per Company	Disc Titles
1983	2	5	10
1984	7	8	56
1986	12	10	120
1988	12	12	144
1990	12	15	180

Source: BCG

Other companies in the transportation industry share similar needs for videodisc-based service training. Large-aircraft manufacturers, such as Boeing, Lockheed, McDonnell-Douglas and AirBus now or will soon, use videodisc-based training. Large aircraft are complex, expensive products. Service is typically performed by the end-users; service training is part of the purchase price. These factors may warrant the use of videodisc-based training. Manufacturers of smaller aircraft typically have few models which are less complex. This, combined with the smaller number of repair facilities, makes the use of interactive videodisc training much less likely.

One class of products that presents a situation roughly analogous to major aircraft manufacturers consists of weapons systems, tanks, armored personnel carriers, ships, and other equipment procured by the armed forces. Both operations and service training are typically part of the total package in major defense procurements of complex equipment. Current DoD experimentation with interactive videodisc may lead to the use of this medium by defense contractors in fulfilling their training obligations. Because such training is limited to a finite task, the operation and maintenance of a particular piece of equipment, and since the number of such complex systems produced in a given year is limited, the number of disc titles that would result is probably rather small. But the disc production contracts, given the complexity and price of the equipment, could be substantial.

Overall, it is reasonable to anticipate that by 1984 20 larger corporations will use interactive videodiscs as a training medium for product service. The growth pattern of usage is likely to proceed on an industry by industry basis, as one or two industry leaders test and adopt the medium and then are followed by their smaller competitors. BCG anticipates that the number of user companies is likely to increase by 50% per year during the next 5 years, with the number of disc editions growing slightly faster. This suggests that by 1986 nearly 60 companies will be commissioning a total of over 500 interactive discs annually.

Product Service Training — Overall

Year	Projected Disc Production	
	Companies Using Disc	Disc Titles
1983	8	60
1984	20	160
1986	60	500
1988	120	1500
1990	200	3000

Source: BCG

D. PRODUCT MARKETING TRAINING

Product marketing training involves familiarizing salespeople with the features of the product to be marketed and training them to sell those features to potential customers. The focus on the product's characteristics distinguishes this sort of training from more generic "how-to-sell" or "how-to-relate-to-customers" sales training. Materials for product marketing training typically involve a great deal of product information; but their purpose is to train salespeople, not to directly promote the product to customers. The following case study examines interactive videodisc product marketing training in the automotive industry.

Case Study — Automotive Marketing Training

Videodisc-based product marketing training has been firmly entrenched at General Motors and Ford for several years. Each annually produces 40-50 dealer discs, approximately 75% of which are product marketing training or promotional discs. Both companies recoup their disc costs from the dealers.

Before moving to videodisc-based sales training and promotion, both Ford and GM had used videocassettes. Two advantages of interactive disc over videocassette prompted the switch. First, the disc offered quicker access to a given piece of material, which made the videodiscs more useful in sales presentations. The videocassette systems had been under utilized. Second, disc provided better quality video. U-matic cassette systems had been used, and videodisc offers better video than any helical-scan tape format smaller than two-inch. Because sales training discs often do double-duty as promotional material, production values in the application are typically higher than in product service training applications. Ford uses Maritz Communications to produce their marketing and merchandising discs, while service training discs are designed in-house and production is farmed out on bids. A concern for higher production values underlies the difference in approach.

American Motors is a useful case study of disc-based sales training because the company was late in starting its disc program (1982) and has many dealers who handle Ford or GM products as well. Whereas Ford and General Motors distribute both marketing and service training discs, AMC only distributes marketing training discs, producing 8 to 10 such discs annually. (BCG's AMC interviewee indicated that a service training disc might be produced in late 1983.)

Prior to the introduction of each year's new models, AMC distributes discs which deliver an overall review of the new model, inform salespeople about its features and options, and provide a competitive analysis with other cars in its class. Additional non-product oriented marketing training discs teach a variety of sales techniques and provide motivational material for slow days. Unlike product service training discs, the marketing training discs have a low level of interactivity, apparently in response to the belief that salesmen want a straightforward delivery of information without intermittent quizzes.

AMC has 1800 dealers, 1200 of whom participate in the videodisc program. Approximately 500 of the participants are "dual dealers" who sell a GM or Ford product along with an AMC product and had already acquired a videodisc system through the larger manufacturers. AMC sold disc systems to the remainder. The company charged dealers $3,000 for the system although financing was available. New dealers, however, must buy the disc system and pay for it within 1 year. AMC charges $50 per disc, which covers replication, packaging, and shipping costs but does not cover production costs. AMC's ability to impose tougher financing arrangements on the dealer's purchase of the player may be a common benefit to a late-comer to a mature industry application.

AMC's adoption of disc-based training indicates that there are competitive pressures on automobile manufacturers to meet the challenge established by the leaders in disc system usage, Ford and GM.

Avon Products

In early 1982, Avon Products announced a plan to distribute videodisc players to the 18,000-20,000 Group Sales Managers who oversee a salesforce composed of 500,000 independent representatives. Avon intended to use videodisc as the primary medium for communication from corporate sales headquarters to the field, providing product information, training, and motivation. Later in the year, however, the company announced that it would use videocassettes instead.

According to Avon, the switch to videocassette was based on a number of considerations. First, because videotape could be recycled at minimal cost, replication on tape was less expensive than disc. Second, turnaround time for disc production, mastering, and replication was too long. A new 25-minute tape is distributed every two weeks. Avon found normal videotape turnaround to be 8-10 weeks, while disc was far longer. Moreover, if necessary, a tape could be produced, replicated, and packaged in three weeks — a feat impossible with disc.

The tapes are typically played at meetings of 10-15 sales representatives. A linear presentation was considered preferable to interactive format for this purpose. Finally, Avon discovered that their sales managers regarded the videocassette recorder as desirable for personal use, and thus saw it as a prerequesite. The disc player was perceived as being more limited — useful only for business purposes.

Observations

The automobile industry is selling a high dollar-margin product and thus can justify substantial spending to familiarize salespeople with the product. The selling process is viewed as particularly important in the automobile industry. The salesperson serves as the primary source of product information and thus has substantial input into the customer's evaluation of the product against similar competing products. The product itself has many features to be explained and many possible options. Acquainting salespeople with the product visually is important, since the appearance of an automobile is typically a crucial factor in the decision to purchase. Manufacturers must address all these issues with a geographically dispersed salesforce.

Although these particular training parameters can and have been addressed by means of printed material, GM and Ford have apparently determined that videodiscs are sufficiently more effective to justify the additional expense. The issue of salesforce motivation may have played an important function in this decision. Simply because videodisc offers moving pictures and sound it tends to be a better motivational tool than print.

One difficulty in using videodisc for new product related training is long turnaround times — it can take from 4 1/2 to 6 months from inception to distribution of a disc. GM's videodisc vendor, the Sandy Corporation, reports a minimum of three months for production under optimum conditions, i.e., when most film can be shot in a studio, and Ford reports 6-8 weeks turnaround on replications as typical. Time for conceptualization, design, and distribution must be added to these turnaround times. The difficulty of reconciling such long lead times with the new product introduction cycle has led Ford to question the wisdom of its decision to adopt videodisc for this application.

Projections for Interactive Disc in Product Marketing Training Applications

To date, only the automotive industry has invested signficantly in disc-based marketing training. But other manufacturers of relatively complex high-ticket products depend upon a knowledgable and well-trained salesforce much as do auto makers. Computer, communications, CAD/CAM, office automation, robotics, and pharmaceutical companies might be well served by interactive disc training. Because computer companies have already begun to use interactive disc in both service training and promotional applications (see Chapter 3), they can be expected to join auto makers in leading the field.

Ironically, the great importance of salesforce effectiveness in these industries, while providing a justification for investment in videodisc-based training, may also slow its initial penetration. Sales training is so important that companies may be reluctant to experiment with new methods. If videodisc proves effective in early tests, however, it will be adopted quickly across a given industry. Moreover, once interactive disc hardware is installed in order to train salespeople, it will likely be used to train service people and technicians as well.

The following table projects disc production for product service training. In line with the argument above, growth is anticipated to be slow through 1986, due to testing by many companies, but much more rapid thereafter as disc is adopted as a standard training medium.

Product Marketing Training

Year	Projected Disc Production Companies Using Disc	Discs per Company	Disc Titles
1983	2	6	12
1984	8	7	56
1986	25	10	250
1988	90	20	1800
1990	200	30	6000

Source: BCG

E. OPERATIONS/APPLICATIONS TRAINING

Manufacturers of several types of particularly complex equipment typically package a certain amount of training in the sale of the product. Service training of this type was mentioned earlier, but training in the operation and application of equipment is even more common. Such training may take the form of printed manuals and self-study courses or credits toward courses at the manufacturer's training center. Manufacturers of expensive and complex industrial, transportation, and medical equipment, as well as military vehicles and weapons, typically provide operations and applications training as part of the equipment package.

A second type of operations and applications training is less focused on the use of a particular piece of equipment than on the procedures essential to a particular task within an organization. The training of bank tellers, for instance, falls into this category; there are a number of standard procedures that the employee must learn in order to function in a teller's position. Another example is employees of a restaurant — particularly a fast-food restaurant that operates according to nationally standardized methods. Procedures training of this sort is typically produced by the employer (or the franchise organization) rather than by manufacturers.

The following will examine the current and potential use of interactive videodisc in both types of operations and applications training, beginning with equipment-oriented training.

Interactive Videodisc and Equipment Operations Training

As mentioned above, training customers how to use the product is a fact of life for almost all manufacturers of complex equipment. There is definite potential for the use of interactive videodisc in providing this training, since the visual component of any such training is likely to be very important. However, actual uses of videodisc for this purpose are thus far relatively isolated. Aircraft manufacturers have invested some money in exploring the use of videodisc for flight simulation and instrument orientation, and the Department of Defense is also exploring this area. The U.S. Postal Service is currently investigating interactive disc as a medium for training employees in the use of postal equipment (and in Post Office procedures).

One industry in particular is likely to experience an explosion in the demand for equipment operations over the next decade — the small computer and office automation industry. Massive increases in the need for training are foreseen as the inevitable consequence of the anticipated rapid growth in demand for this equipment.

A New York Times review of several major computer market forecasts determined that IBM alone is likely to sell 400,000 to 500,000 desktop computers in 1983 (NYT, 3/27/83, section 3, page 1). The Yankee Group estimates that there will be 4.2 million desktop computers and 800,000 word processors sold in 1985. Greater office automation demands greater workforce knowledge of basic keyboard and video display skills. Users of automated office equipment are likely to be clerical support or management personnel rather than data processing professionals. A customer without the requisite computer education, or access to inexpensive and appropriate training, is not likely to invest $5000 to $10,000 in a desktop computer or word processor. Turnover in personnel will also significantly add to this training demand. It becomes essential, therefore, for office automation companies to provide low cost training if they are to capture a respectable share of the office market while the market is in a period of rapid growth.

The following case study illustrates the potential use of interactive disc to meet the operations training needs of this industry.

Case Study — Computer Company Training Of Customers in Computer Operations

IBM saw its customer training load for a particular office computer model double within the three year period ending in 1981 — a period in which desktop computer sales were well below projected levels. The company met its customer training needs by establishing approximately 50 videodisc-based learning centers around the U.S. Each center is run as a profit center and equipped with three learning stations. The company makes 400 disc copies of each course to fill training demand. The major inducement to use videodiscs in response to this training need was their cost-effectiveness compared to using instructors.

The purpose of IBM's course is to teach basic computer operation and specific product use in office applications. Special aspects of this training include its approach toward the use of video and the use of an outboard "surrogate" device which is also the subject of the course: a computer terminal. Video material is presented at the beginning of each "module" of the course in a 5-6 minute segment to teach concepts the student needs to understand visually. After using workbooks and reference materials to fill in details, the student performs exercises on the "surrogate" computer terminal. If mistakes are made, remedial video material is presented or portions of the printed text are suggested for additional information. Once the trainee's understanding of the material is confirmed by the successful completion of keyboard exercises, video is again used to summarize the module.

The company's learning centers have been successful; but with only 3 learning stations at each of 50 centers, the company's future customer training loads will not be adequately served. Moreover, the same customers will require training from independent suppliers of software and hardware peripherals.

Observations

Obviously, IBM is not the only manufacturer of small computers and office automation equipment that finds itself faced with the development and provision of extensive operations training to support growing customer demand. The availability and quality of operations training has already become a competitive issue among industry leaders, and it is likely to become more important as the market grows.

There are several reasons to believe that interactive videodisc will become the preferred medium for this training task, and the impact on the installed base of disc players in offices (and perhaps homes) could be sizable. First, computer and office automation companies are comfortable with new technology solutions to problems. Second, there is a large visual component in the training of the use of this equipment. Third, if the "intelligence" is taken out of the disc player and placed in a personal computer to which the player is connected, the cost of the players will drop, and many disc player compatibility issues will be minimized.

In fact, the product being explained can function as a component of the training system. Some interviewees have suggested that it is reasonable to expect the near-term introduction of a "dumb" laser disc player specifically configured as a desktop computer peripheral. At a retail price of $400 to $600, the disc player could be sold as a computer peripheral and at the same time provide a training mechanism for computer product vendors. At the very least, such an inexpensive disc player could be rented by the customer when there is a need for computer product training.

New products such as Apple Computer's "Lisa" and VisiCorp's "VisiOn", promise to provide workers with "user-friendly" computers designed to overcome much of the initial discomfort workers have in dealing with office automation equipment. This approach may dramatically reduce basic operations training needs, but Apple is reported to have spent $50 million developing Lisa (Wall Street Journal, 4/14,83, page 31), money which could buy many general purpose disc players and computer operations course discs. Other companies provide floppy disc-based training for the most popular software, such as WordStar or VisiCalc, but these courses lack the important video components.

Office automation may ultimately generate a sizable market for videodisc training. The concept of an automated office envisions interconnecting all the word processing, data retrieval, accounting, and computing devices of a large office using a local area network. Virtually every employee in such an office has access to a work station consisting of a computer keyboard and a video terminal. Central processing units, digital data storage devices, printers, and video delivery mechanisms (including videotext and videodisc systems) are accessible to every office employee through the network. Given the relatively high turnover among clerical personnel, such sophistication will generate a critical need to quickly instruct new employees in the use of the automated office equipment. Computer-based videotext and videodisc instruction courses are expected to be part of the network's program library, along with printed employee workbooks.

Such delivery of training materials need not be limited solely to automated office equipment, but can extend to training in corporate products, services, policies and benefits, office procedures, interpersonal relations, management topics, sales training, field service training, and other subjects for which computer-based or videodisc-based instruction is appropriate. Several key interviewees suggested that such a scenario would not be unlikely by the end of 1984.

Whatever the strategy for delivery of videodisc hardware, there are compelling reasons to believe that the proliferation of desktop computers will significantly increase the number of installed laser disc players and the market for interactive disc analysis, design, production, premastering, and replication services.

Projections for Interactive Videodisc in Equipment Operations Training

Projecting the future of videodisc in equipment operations training involves a good deal more speculation than in the two preceding training categories, because there are many training alternatives in this area. Some equipment demands intensive schooling; some can be used effectively after minimal hands-on experience. Moreover, few companies have as yet committed themselves to using interactive videodisc for this purpose.

Nevertheless, the growth of interactive disc in this application will be very rapid if it proves to be an effective training alternative, and it is likely to be effective for many types of equipment. Equipment operations training is typically a more complex task than the training discussed earlier and will demand a higher level of interactivity and more complex disc design.

Equipment Operations Training

Year	Projected Disc Production	
	Companies Using Disc	Disc Titles
1984	6	20
1986	15	50
1988	30	120
1990	60	250

Source: BCG

Interactive Videodisc and Employee Procedures Training

A second common type of operations/applications training teaches employees not how to operate job-related equipment, but how to effectively carry out various procedural elements of their jobs. McDonalds' employees must learn to make Big Macs; lab technicians must be taught laboratory safety procedures; policemen need to know how to fill out an arrest report; and Holiday Inn managers are trained to use the company's reservation information network. Any of these tasks may involve the use of equipment, but the focus of the training is on the task and the procedures that are involved in completing it.

The training of new bank tellers is a classic instance of employee procedures training; the job involves the use of some simple office equipment, but the major task of training is to school employees in a variety of standard procedures that go into operating a teller window. The following case study describes Bank of America's application of interactive videodisc technology to this training task.

Case Study — Bank of America's Interactive Videodisc Teller Training Program

Bank of America, one of the nation's largest financial services institutions, has produced two training packages utilizing interactive videodisc. Both were undertaken as pilot projects to explore the potential of interactive disc training and represent a natural outgrowth of the bank's established use of various technologies for both training and internal communications. The bank has a large and sophisticated media services department in its San Francisco headquarters.

Both videodisc projects were intended to school tellers in basic procedures. The first program, which required a single disc side, focused on procedures for handling various types of customer transactions and the use of various bank stamps. The second program occupied four disc sides and provided training in customer relations skills. Both programs present visual material followed by multiple choice questions that ask for trainee decisions. Correct answers allow the trainee to move to the next stage of instruction. If the trainee answers incorrectly, the section is reviewed. Occasionally, the program shows the trainee the consequences of an incorrect decision.

Bank of America's media sevices department handled design and video production for the discs. Both Pioneer and Sony were used for mastering and replication. A media services spokesperson interviewed by BCG noted that neither of the manufacturers were particularly helpful in the design, production, and premastering stages of the process. The cost of the first training program was approximately $40,000, while the second was 2-3 times as expensive.

Despite the high level of interactivity incorporated in the programs, no outboard computer was used. The in-board microprocessor on the Sony and Pioneer industrial players were used to control the presentation, and "were stretched to the limits of their capacity," according to the spokesman.

Although the training programs were designed for individualized instruction, their actual use in the field has not followed this pattern. Bank of America trains its tellers regionally through classroom instruction. The training discs ar e used primarily as a teacher's audiovisual aid in this classroom setting. Individualized use is reserved for trainees who need additional exposure to material covered in classroom instruction.

Bank of America has no plans to produce another disc in the near future. The spokesman interviewed noted that the bulk of the media services department's output is on videocassette, which serves as the primary medium for communicating changes in bank policies, services, and procedures. This is regarded as "soft" training — primarily information and motivation — which has a short life span and requires a relatively fast production turnaround time. Because cassettes of this type are sent to 1500 branch offices, the cost of blank cassettes alone is quite large, and the media services department offsets this cost by reusing tape. According to the spokesman, interactive videodisc is too expensive and requires too great a turnaround time to be practical for these "soft" applications.

The future of interactive videodisc is uncertain at Bank of America, but if it continues to be used, its near-term application will be for "hard" training, i.e., training in basic employee procedures.

It has been widely reported that Bank of America intends to market one or both of its training discs to other banks. BCG's interviewee said no decision on marketing either disc had been reached. A primary impediment is the lack of an installed base of players. Conversations with Pioneer and Sony are underway concerning the possibility of marketing the discs in packages with disc players.

Observations

A number of observations about potential applications of interactive videodisc in employee procedures training can be drawn from Bank of America's experience. First, in order to justify the use of interactive videodisc, the job must be relatively complex. Making Big Macs, for instance, and performing other tasks that make up the job of a counter employee at McDonald's, are probably too easily learned to justify the costs of videodisc-based training. Most of the required procedures can probably be mastered in a few hours of observation and practice. Moreover, the consequences of a single mistake are not severe.

Bank telling, on the other hand, requires extensive classroom training, both because of the complexity of the job and the potentially large expense of employee error. Both factors are important in justifying the move to videodisc-based training.

Other factors likely to induce disc-based training are the skill-levels and academic training of entering personnel. Obviously, less training is needed if a new employee already knows how to do the job. Much of the job at McDonald's, to return to that example, is made up of basic kitchen skills common to most new employees. Lower levels of academic attainment will tend to lengthen the necessary training period and make printed training materials less effective. The U.S. Postal Service, for instance, has invested heavily in audiovisual training media because of the poor reading skills among entry-level employees.

Generally, the costs of interactive disc training will be more easily borne if the procedures to be taught (at least initially) are basic to performing the job. Unless the teller knows how to process customer deposits and withdrawals, for example, he or she cannot perform the job. Basic procedures like this are more likely to drive the adoption of videodisc-based training than skills which enhance performance but are less crucial — personal relations skills, for instance.

The use of videodisc procedures for training will develop more quickly where the simulation of "real-life" situations is important. In teller training, video disc can present mock transactions which begin with customers approaching the teller's window. Some jobs, such as strictly clerical positions, may not benefit from a video presentation and can be taught as easily through programmed workbooks. However, as interactive videodisc continues to prove its effectiveness as a training medium in general, its use to teach skills that do not necessarily demand video representation will expand.

One of the primary impediments to the spread of videodisc-based training is its cost. The price of a videodisc player and outboard microcomputer represent fixed costs that must be borne regardless of how many employees are trained per month, although reduced training time may justify videodisc hardware costs for training even a few employees. To justify the hardware expenditure, a company must have a sufficient number of employees doing the same type of job within reasonable proximity. But hardware costs pale in comparison to the cost of videodisc production; a simple disc with a table of contents and multiple choice questions can easily cost $40,000. Even if disc reduces training costs per employee, a company would need to train many employees to justify the expense. On the other hand, if an off-the-shelf disc capable of teaching the appropriate procedures were available for $500-$600, disc-based training would become affordable for many more companies in a given industry. Bank of America's teller training discs, if brought to market, will represent such an opportunity for smaller banks.

The Future of Interactive Disc in Employee Procedures Training

The Bank of America case suggests a likely scenario for the development of a market for videodisc-based training of employee procedures. Suppose that a large company, perhaps in conjunction with a videodisc production house, decides to produce an employee procedures disc, the cost of which can be justified on the basis of internal training needs. The disc is then marketed, either by the company itself or by the production house, to other companies in the same industry. Since the cost of the disc is already justified internally by the sponsoring company, the risk of bringing it into an uncertain market is significantly reduced.

In such a scenario, the first disc produced will not only have to sell a particular set of procedures adopted by a company, but, in most cases, it must also sell hardware and the concept of videodisc-based training itself. Typically, there will be no installed base of players, making the reputation of the sponsoring firm crucial. Once the first disc is sold to a large base of companies within the industry, however, a market for future discs will be established and an installed base of players will exist. Because the successful marketing of one disc training package leaves in its wake an installed base of players, interactive videodisc training can penetrate an industry very quickly. In the automotive industry videodisc became a mature training medium in three years. A similar pattern appears to be emerging in the computer industry.

As noted earlier, the spread of interactive videodisc training is likely to follow an industry-by-industry pattern, and employee procedures applications will prove no exception to this general trend. This suggests that videodisc producers should identify particular industries which offer likely applications for disc-based training, identify the leading companies within the industry, and sell them on the concept of interactive videodisc. A number of industries can be identified as likely candidates for disc-based procedures training.

- Banks. Bank of America is in a position to develop this market. Teller training, which involves many standardized but complex procedures is a natural application for interactive video. On the other hand, it might be more difficult to market a disc for loan officer training since the procedures involved vary significantly from bank to bank due to variations in bank policies and banking regulations in different states.

- Insurance, securities, accounting, and tax form preparation. Like the banking business, both these industries involve jobs with standardized procedures which are periodically updated or altered because of policy or regulatory changes.

- Law enforcement. Arrest procedures and reports, treatment of suspects relative to their civil rights, human relations skills — all these are relatively standard procedures. A videodisc sponsored by a well-respected urban police department or by the FBI might achieve wide acceptance in law enforcement agencies.

- Hospitals. The continuing education of nurses and other hospital employees may involve enough standardized procedures to represent an appropriate use of interactive videodisc. Companies, such as Humana, which own many hospitals could justify the production costs of discs for internal training needs.

- Military training. The basic training of military recruits involves a vast array of standardized procedures and a large body of employees to be trained. The low educational level of incoming recruits may also make videodisc training preferable to print. However, the established pattern of training recruits in squads may to some extent mitigate against the adoption of individualized interactive videodisc instruction.

- The Postal Service has in the past depended on audiovisual instruction to overcome the poor reading skills of entering employees. Many standard procedures are involved in Post Office work, and the smaller number of employees entering at any one time may make individualized instruction desirable. The Postal Service has in fact begun to investigate the possibility of using videodisc-based training.

- Chemical companies. Laboratory procedures are fairly standard across the industry. Moreover, many procedures involving hazardous substances can put the trainee at risk. Videodisc offers a mechanism for showing the harmful effects of mistakes without actually endangering the employee.

- Professional development and certification. Maintaining high levels off proficiency, increasing and enhancing skills, refresher training, and new information dissemination for professionals in various disciplines, including lawyers, engineers, architects, certified public accountants and health care administrators, lend themselves to interactive instructional techniques. Hoever, economic issues, as well as questions of standardization and who will bear videodisc production costs, stand in the way of widespread near-term acceptance of interactive viceodisc applications for these areas.

The list could be extended. Employee procedures training represents a potentially large market for interactive videodisc services, which is likely to develop on an industry-by-industry basis. Despite the size of the potential market, the rate at which it will develop is hard to project. Present use of disc in this activity is very limited. Moreover, the scenario sketched above presents a number of conditions for the market's development that are hard to forecast. The costs of videodisc production mitigate against any but very large companies being able to justify the costs of custom-produced discs. The market will develop as such companies market discs produced to meet their own training needs to the industry at large. It is reasonable to assume that the market will begin to develop in 1986, and grow into a significant market by the end of the decade.

Employees Procedures Training

Year	Projected Disc Production Titles
1986	20
1988	100
1990	500

Source: BCG

F. GENERIC TRAINING

A final category of training material which may represent a significant market for interactive videodisc is generic, or "off-the-shelf", training — i.e., the use of pre-packaged courses to train employees in broader subject areas. For instance, many generic courses in sales skills, customer and employee relations techniques, managerial development, accounting procedures, laboratory techniques, and others are available in various media. About 30% of domestic industry's external training expenditures ($680 million) are now devoted to off-the-shelf materials, and this ratio is expected to exceed 40% by 1990 (see Chapter 2, Section A).

Interactive videodisc-based generic training will likely come from two sources: courseware companies and manufacturers of computers or videodisc players. Once there is an installed base of interactive videodisc players in business and industry, courseware companies will produce disc-based generic training as a natural outgrowth of their present business. Their interactive training programs will be developed in three ways: by converting existing generic training packages to interactive videodisc format, by generalizing interactive disc courses custom-produced for clients, and through the development of new interactive disc courses. A number of courseware companies are currently producing interactive videodiscs, typically as custom-design projects for clients. This experimentation is expected to continue as courseware producers attempt to gain experience in the medium and position themselves for eventual entry once the market develops.

The second likely source of generic interactive disc training will be computer and videodisc player manufacturers. These companies will produce generic courses in order to support and encourage hardware sales. Their courses will typically be either generalized versions of custom-designed products or start-up generic productions. One major U.S. computer manufacturer interviewed by BCG recently decided to enter the courseware production and distribution business with an emphasis on interactive videodisc training. The company has acquired a great deal of experience in the production and application of computer-assisted instruction and interactive videodisc training by using both for internal training purposes. It has also used both media to train customers in the operation and application of its products. The company intends to expand this base by developing courseware in other areas of training on a custom-design basis for its Fortune 200 customers. These courses will then be generalized and sold as off-the-shelf training packages. For example, an interactive disc course now being produced to teach laboratory techniques was commissioned by a large chemical company. It will ultimately be generalized and sold to chemical companies with similar laboratory technician training needs.

Strategically, this company has both an offensive and defensive approach to the market. Offensively, opportunities are created to sell hardware and courseware to new and existing customers via new channels, such as in-house planning and training departments. Defensively, it impedes encroachment on an estabished clientele by competitors selling videodisc courseware systems.

Several major computer companies have acquired sufficient expertise in designing computer-assisted instruction and videodisc-based training courses to adopt a similar approach. A number of them are currently designing courses for such companies as Kodak, General Electric, AT&T, Dupont, Applicon, Computervision, and Gould. Course topics include laboratory techniques, field service, management and marketing skills, product marketing, and continuing education for health management. Training on such topics will likely be generalized and marketed across a wide range of industries and companies.

The Potential for Interactive Videodisc in Generic Training

A demand for off-the-shelf training exists and is growing. Two factors in particular will influence the penetration of interactive disc in this market: the economics of producing generic discs and the available pool of buyers.

A hypothetical model based on general concensus in the training industry can serve to illustrate the economics of generic interactive disc training. Assume that companies would be willing to pay $500 for a two-disc course useful to 20 or more employees per year. The typical design, production, mastering and replication costs associated with such a project are expected to be approximately $200,000. Another $25,000 is spent on marketing the course, along with $50 per disc in variable costs (packaging, mailing, billing, and supplementary printed materials). Subtracting the variable costs from the selling price, the producer expects each sale to contribute $450 against fixed costs of $225,000. The producer will realize a return on investment after selling 500 courses. Generalizing a disc which was custom produced for a single company significantly lowers the break-even point by reducing both design and production costs, even if the original client demands a sizable royalty payment for use of the material. (How large such royalties might be is unclear; no precedents have been set.) Because of this advantage, the generalization of custom courses is likely to lead the market's development.

A disc producer's ability to sell 500 courses will be affected greatly by the number of potential customers — or, in other words, by the installed base of interactive disc players in the target industry or industries.

Generic training more than any other type of training is affected by the "chicken-and-egg" problem: companies are not likely to invest in interactive videodisc hardware unless it gives them access to a desirable array of software, and the development of a large base of interactive software will not be developed in the absence of an installed base of players large enough to ensure a return on investment. Other training applications provide significantly more impetus for hardware purchases.

The development of a large generic training market for interactive disc will be closely tied to hardware penetration. Therefore, its growth will be significantly slower than the markets for more specialized training applications discussed above.

Generic Training

Year	Projected Disc Production Titles
1986	10
1988	50
1990	200

Source: BCG

G. THE TRAINING MARKET FOR INTERACTIVE VIDEODISC — SUMMARY

The training market shows greater potential as a market for interactive videodisc than any other market examined in this report. However, it consists of segments which have their own characteristics and conditions for development and which will therefore develop at different rates. In certain industries, partcularly the automobile and computer industries, and certain applications, such as product service and product marketing training, interactive videodisc has already attained the status of a mature medium. In other types of training, such as employee procedures training, interactive disc remains relatively experimental. Still others, like generic training, await the development of a sizable installed base of players.

The application of interactive disc to these various training tasks will develop at different speeds. But growth in one application will spur growth in the others. One reason for this is the presence of the disc player itself. When a company invests in interactive disc training for one type of training it acquires an installed base of interactive players which can, and typically will, be used for other types of training.

Two other points drawn from the preceding discussion bear reiteration. First, a company's or industry's initial shift to interactive disc training often depends upon the existence of a "window of opportunity." In the case of General Motors and Ford, the rapid multiplication of ne models strained existing training methods; both mechanics and salespeople needed much more training to become acquainted with the new products. A window of opportunity was opened for a new training medium. Similarly, the exponential growth of the office automation equipment market produced a window of opportunity for interactive disc in that industry. Such developments make the cost of a new training medium easier to justify; it is bundled with the cost of meeting a new business situation.

The second point worth repeating is that the use of interactive videodisc for training is likely to develop on an industry-by-industry basis, a pattern that has emerged in the automotive and computer industries. The industry leaders have adopted videodisc and the rest of the industry plans to follow. This pattern of development is particularly likely in instances where training becomes a competitive issue. For example, in the office automation industry the quality of customer training is a critical component of the product itself.

Market-wide Projections

The training market is currently the most developed market for interactive videodisc, and it will retain that edge through the end of the decade. The following table totals the projections for individual segments developed in the preceding discussion and translates them into estimates of spending for interactive videodisc production.

Training Market — Overall

	Year			
	1984	1986	1988	1990
Disc Titles Produced	236	830	2570	9950
Average Production Cost per Disc* ($000)	$80	$ 90	$100	$ 110
Total Production Expenditures* ($millions)	$19	$ 75	$257	$1,096

*Projected costs and expenditures are given in 1983 dollars and reflect both an expected 10% annual rate of inflation and experience-curve effects on production and manufacturing costs.

Production expenditures for interactive training discs can reasonably be expected to exceed $1 billion by 1990. Earlier, the total market for training software in 1990 was projected to be $33 billion. Interactive videodisc, then, expected to capture 2-3% of this market by the end of the decade.

CHAPTER 3

MARKETING AND MERCHANDISING

The preceding chapter discussed the use of interactive videodisc technology to train salespeople — specifically, to familiarize them with new products. "If interactive disc can be used to give salespeople product information," one might ask, "couldn't it be used to give customers the same information?" Indeed, a number of companies in various industries are currently testing effectiveness of interactive videodisc as a marketing tool. This chapter assesses the larger market for mediated materials in support of sales efforts, current interactive videodisc activity in this market, and the volume of business that marketing and merchandising applications are likely to produce for the videodisc industry through the end of the decade.

Interactive disc can be used in merchandising and marketing in at least three distinct ways: as a medium for point-of-sale promotional material and information, as audiovisual support in the context of a larger sales presentation, or as a catalog. The following sections address each of these applications.

A. INTERACTIVE VIDEODISC IN POINT-OF-SALE PROMOTION

The Broader Market

"Point-of-sale" (POS) is the most common form of retail advertising. The category includes an extremely varied set of media — from promotional display racks to mannequins to audiovisual productions — which share one characteristic: they are located where purchase transactions take place, typically on a sales or showroom floor. Although point-of-sale promotion accounts for only 10-15% of total advertising volume in the U.S., it is still a sizable industry. In 1982, $5.9 billion was spent on POS, according to the Point of Purchase Advertising Institute (POPAI).

The $5.9 billion in 1982 POS volume reflects an increase of only 7% over 1981 volume; however, this slow growth rate is viewed as a product of the then generally sluggish economy. Data from earlier years suggests that projecting an annual compound growth rate of 15% is reasonable. The table below projects volume growth through 1990 at this rate.

Projected Point-of-Purchase Advertising Volume

Billions of Dollars* — Projected					
1982	1984	1986	1988	1990	Annual Growth
$ 5.9	$ 7.8	$10.3	$13.6	$18.0	15%

Source: Point of Purchase Advertising Institute, BCG projections.

*All dollar amounts are in current dollars and reflect an annual inflation rate of 10%.

These figures represent a conservative estimate. Historic data obtained from POPAI reflects an estimate of total volume based on the volume reported by POPAI membership, and the institute is improving its data-collection techniques because current methods are suspected to miss a significant portion of actual volume. Moreover, the bewildering variety of media used in this form of promotion makes it likely that substantial volume is untraceable. The figures given above may account, therefore, for two-thirds or less of total POS volume.

Current POS Applications

In contrast to videodisc-based training, interactive disc is not a mature medium for POS promotion. However, interactive disc is thought to have great potential in this area. The sheer volume of dollars available for advertising expenditures and the great importance attached to the search for more effective promotional media have resulted in numerous experiments involving videodisc promotion. The case studies that follow describe two such experiments.

Case Study — General Motors — Retail Automotive Sales

General Motors first installed DiscoVision disc players in retail dealer showrooms in 1979 to replace POS "mini theatres" equipped with super-8mm loop cartridges. GM-produced discs cover its full line of automobiles, providing technical and warranty information, and detailed photo-essays describing various models and options. Use of the discs is particularly high during the first month after new product introductions.

Salespeople reported that use of the disc system resulted in shorter, more concise, and more credible sales presentations. They said the videodiscs were particularly effective in delivering information on finer points such as warranties, insurance, etc. They also aided the presentation of complex features such as engine construction. Moreover, the videodisc system easily displayed various combinations of options, colors, interiors, etc., not in the dealer's stock.

Although some salespeople found the disc system overly complicated, it became a standard technique in the sales repertoire of most. Salespeople discovered that the disc system was effective in handling two customers simultaneously. One customer could use the videodisc kiosk for an entertaining presentation of basic information while the salesperson attended personally to the first customer.

Case Study — Retail Sales of Personal Computers

Although automotive manufacturers pioneered the use of videodisc for retail sales applications, desktop computer manufacturers are rapidly adopting the new medium. At least three major personal computer manufacturers are currently using or planning to use videodisc POS kiosks to support sales in retail outlets.

In April 1983, Apple Computer made kiosks available to retail computer stores handling Apple products. The Apple kiosk includes a laser videodisc player, a touch-sensitive color monitor, and a computer interface which the dealers obtain from Apple under a 3-year lease agreement. The dealer provides an Apple IIe personal computer with floppy disk drive to complete the system. When not in use by a customer, the video screen displays the Apple logo and the words "Touch Me." When a customer touches the screen, Dick Cavett appears and asks the customer to choose from a menu of topics. Apple's first disc includes segments on word processing, information management, electronic spreadsheets, the Apple IIe, a catalog of Apple products and a guide to personal computer applications.

IBM has installed a limited number of kiosks in its company-owned Product Centers and plans to place kiosks promoting the IBM Personal Computer in independent retail stores by the end of 1983. Atari is involved in a project dubbed "Eric" — a videodisc kiosk intended for installation at J.C. Penney stores.

These videodisc projects aim to solve a particular problem. Small computer retailers generally stock several different computer brands, each with a variety of standard models which in turn have a variety of different peripheral and software configurations. Under these circumstances it is difficult to maintain a knowledgable sales staff, and thus manufacturers cannot depend on independent salesforces to adequately represent their products.

Compounding the problem, although most customers are not experienced desktop computer purchasers, they are intelligent customers who demand specific information on a product's ability to meet their needs. The current flood of magazines, manuals, seminars, and consultants purporting to aid consumers in selecting computer hardware and software are products of this information gap — products over which computer manufacturers have little control. The videodisc kiosk represents one route they have chosen to deal with the demand for information.

The large investment manufacturers have committed to retail kiosks suggests that they are competing not only for customers, but for channels of distribution as well. This becomes apparent when the economics of Apple Computer's program are analyzed. A kiosk consisting of a videodisc player, a touch-sensitive monitor, and interface easily costs $3000. When multiplied by 1200 locations, Apple's kiosks represent an investment of approximately $3.5 million. Even with some recovery of investment from dealer lease fees, Apple's commitment remains sizable. Because very high quality discs are required for such a demanding task, their production cost is estimated to be around $250,000, which brings the total project investment to approximately $4 million.

From a retailer's perspective, there is a limit to the floor space that can be devoted to kiosks — particularly when their effectiveness is untested. An undoubtedly important factor in the decision to use videodisc kiosks is the rapid loss of Apple's once dominant share of the small computer market to IBM. This also explains IBM's quick subsequent move to provide videodisc kiosks to its independent retailers.

Observations

The preceding case studies prompt a number of observations about the use of interactive videodisc for POS promotion. In each, the products involved are relatively complex — both automobiles and personal computers have a wide variety of features and options that are important to the customer's purchase decision. This variety, when compounded by the number of different models with which salespeople must be familiar, produces a need for a salespeople to provide more and better service customer information. By using interactive disc, the salesforce, or the customers themselves, can tailor a sales presentation to address specific needs.

Automobiles are high dollar-margin products. Thus the cost of videodisc-based promotion can be easily justified. Though the margin on personal computers is comparatively less, manufacturer competition for channels of distribution warrants the expense of videodisc kiosks. Both products are being sold in very competitive environments, which generates a need for very high quality promotional materials. In both automotive dealerships and retail computer stores, the manufacturer has little control over the character of the salesforce itself. The videodisc medium provides direct contact between manufacturer and consumer.

Other sales settings that share some or all of these characteristics offer potential markets for POS applications of interactive videodisc. The marketing of photographic equipment, for example, resembles in various ways both automotive sales and small computer retailing. Customers are typically interested in exploring a variety of options and may require technical help beyond the expertise of the salesforce. Moreover, the manufacturer's control over the salesforce is limited. A videodisc kiosk could show a wide variety of cameras and accessories; photographs taken with various lenses could be displayed; and technical information could be dispensed. However, because competition for channels of distribution is less of an issue for photographic product manufacturers, they are not likely to bear the full cost of either the videodisc kiosk or the promotional discs.

Retailers in general may be unable to justify an investment in videodisc hardware unless they can be sure either of a steady supply of promotional discs covering a broad spectrum of their product lines or of the ability of videodisc kiosks to increase sales of high margin items. Even if the manufacturer pays for the kiosk, retailers will probably expect to see a higher return per square foot of floor space in order to justify the space the kiosk occupies.

The Potential Market for Interactive Videodisc in POS Applications

POS promotion represents a large potential market for videodisc simply because of the wide variety of products for which it could be used. The fact that Nolan Bushnell, the founder of Atari, recently formed a videodisc POS company testifies to the market's perceived potential.

The next two years can expect to see continued growth of interactive videodisc in the automotive and small computer industries, particularly as small companies are forced to turn to videodisc POS to compete with the larger companies mentioned in the preceding case studies. GM, Ford, and AMC are already using videodiscs, and three or four smaller manufacturers, such as Chrysler, VW/Porsche/Audi, Toyota, and Datsun are likely to follow suit in 1984. Similarly, three or four additional small business computer manufacturers (such as Sony, Commodore, Texas Instruments, and Digital) are expected to move to videodiscs. POS discs, but not kiosks, are likely to come from one or two of the larger software firms like VisiCorp or Peachtree. Such a level of entry in these two industries would produce a minimum of 20 discs, and possibly more than 30 — all highly interactive.

Later growth in this market is likely to come in two ways. First, competitors will produce discs to be played on existing kiosks. Once kiosks are in the hands of retailers, it will be difficult for manufacturers to control their use. Second, the technology will spread to new industries and retail outlets. For example, hardware stores may use videodisc POS promotion for power and hand tools and lawn and garden products. The projections below assume a rapid growth rate both because of the large number of industries that could use videodisc POS effectively and because of the great amount of attention advertisers traditionally devote to POS promotion.

Point-of-Sale Market

Year	Projected Disc Production Titles
1984	30
1986	190
1988	1200
1990	7300

Source: BCG

B. INTERACTIVE VIDEODISC IN SUPPORT OF SALES

In addition to serving as a medium for POS promotion, interactive videodisc can serve as a medium for audiovisual segments of larger sales presentations. In contrast to most POS applications, where the customer interacts directly with the machine, in sales support applications the salesman controls the machine. The videodisc presentation will typically account for a smaller portion of the overall presentation than in POS applications. This application will develop primarily in the environment of high-ticket industrial selling, such as that described in the following case study.

Case Study — Mainframe Computer Industrial Sales — IBM

IBM has installed 170 videodisc-based "Branch Office Presentation Systems" (BOPS) to support marketing to national accounts. The systems are used as one element in a comprehensive sales presentation conducted at IBM's branch offices.

BOPS consists of a Pioneer industrial player, a 25" RCA color television monitor, and a stereo sound system. Hardware acquisition costs for 170 systems totaled $800,000. Eight discs have been made to date, with production and replication costs totaling $1.5 million.

A number of factors make the use of interactive disc reasonable in this setting. Although mainframe computers are general purpose computers, customers are interested in the mainframe as a solution to specific problems. The amount of information an individual sales representative needs to know to cover all the customer's questions is tremendous. The branching and indexing capabilities of interactive disc enables the salesperson to tailor the presentation to include segments addressing the customer's needs in detail.

In addition, marketing expensive computer systems to a national account demands selling to many individual users within the customer organization, in order to ease the corporate decision to buy from a particular manufacturer. Thus there is a need for high-quality sales presentations on a geographically dispersed basis. Typically, the vendor-customer relationship has existed over many years, so that national accounts selling involves an on-going public relations effort directed at middle management coupled with information on new products, applications, etc. Interactive disc is particularly suited to providing high-quality, tailored promotion at dispersed locations.

At IBM, BOPS disc projects initiated by various departments within the National Accounts Marketing Group are implemented by a Videodisc Program Group. The program group guides the initial planning of the disc programs and shepherds the project through the stages of disc production. All production, as well as analysis, design, and scripting, are performed by outside vendors working closely with the program group.

The Videodisc Program Group expects to make a minimum of six to ten discs within the next year, but this number could increase to 20 or 30 discs if the program is deemed effective. Measurement of effectiveness is based on word-of-mouth feedback from field sales representatives to headquarters.

According to the executive heading the BOPS program, the greatest constraint on employment of the system is the acute shortage of qualified outside vendors of videodisc design and analysis, production, and premastering capabilities. To the extent that such qualified vendors exist, they often cannot provide services within limited timeframes.

The Future of Interactive Disc in Support of Sales

Mainframe computers are very high-margin, low-volume products with an almost limitless array of possible applications and configurations. The market for mainframes is highly competitive. These factors combine to make the sales process crucial to success in the industry. A highly flexible medium for conveying promotional material of high quality — in other words, a medium like videodisc — is of great value in such a setting. For this reason, videodisc will likely be used widely to support industrial sales.

The sales of many types of industrial equipment — machine tools, construction and excavation equipment, robotics, etc. — resemble mainframe computer sales, although few other products have as broad an array of possible applications. Sales of office equipment to large accounts — particularly as integrated office automation grows — might represent another area in which high margins; a multiplication of features, options, and applications; and intense competition may combine to produce a setting in which interactive videodisc presentations provide a useful addition to the repertoire of sales techniques.

Videodiscs might be employed in trade show displays as well as in standard sales presentations. It is not unusual for a major company to spend $300,000-$400,000 to appear at a regional trade show or to budget $2 million-$3 million annually for this purpose. Costs of trade show exhibition are currently rising at 12%-15% per year. Videodiscs developed for sales presentations could easily be used in a trade show display and thus serve a dual purpose.

The table below projects the growth of interactive disc in the sales support application.

Sales Support Market

Year	Projected Disc Production Titles
1984	20
1986	80
1988	500
1990	3,200

Source: BCG

These figures assume particularly rapid growth after the expected introduction of integrated portable videodisc display units in 1986.

Sales support applications may not require as much interactivity as POS applications. POS discs must guide a consumer unfamiliar with the product or the disc player through a sales presentation; in sales support applications, a salesperson will be on hand to structure the presentation. The ability of the player to accept programming by the salesperson before the presentation will be more important than interactivity built into the disc itself. A typical sales support disc may be a simple archive of visual images and motion segments, the display of which is tailored to serve a given sales presentation through pre-programming of an onboard or outboard computer. For these reasons, sales support applications will likely generate less demand than POS for sophisticated videodisc design services.

C. VIDEODISC CATALOGS

Videodisc catalogs constitute the third marketing and merchandising application of interactive videodisc. (Another form of cataloging, the storage and dissemination of records, periodicals, etc. analogous to current uses of microfilm and microfiche, is discussed in a later section on archiving applications.) Cataloging applications differ from sales support applications in that the customer typically uses a catalog more or less independently of salespeople. Often the customer has decided upon the general class of product to be purchased, and refers to a catalog to choose a specific product from within the class. Moreover, the catalog's contents tend to be more descriptive and informative than promotional. Sales materials are designed to be persuasive, whereas catalogs are designed to be efficient reference mechanisms for identifying specific products. However, in many cases the distinction between catalogs and POS promotional materials is not as clear, and some proposed videodisc catalogs make the distinction even less apparent.

The Broader Market for Catalogs

Industry statistics gathered by the U.S. Department of Commerce indicate that the publishing of printed catalogs and directories generated more than $800 million in revenues in 1982. An annual growth rate of 9.% is expected through the end of the decade, producing shipments worth nearly $1.7 billion in 1990 (see table below).

Industry Shipments of Catalogs and Directories

Millions of Dollars* — Projected

1982	1984	1986	1988	1990	Annual Growth
$829	$985	$1170	$1390	$1651	9.%

Source: U.S. Outlook, BCG projections.

*All dollar amounts are in current dollars and reflect an inflation rate of 10%.

Growth in shipments of catalogs and directories of all types may exceed this level, however. Government figures include only printed versions of these publications, and the projected growth rate reflects expected losses to various electronic forms of cataloging — particularly computer-based. The catalog publishing industry has been hard hit over the past decade by rapidly escalating costs of paper, ink, and printing; and this trend is expected to continue.

In selected applications where catalogs are sufficiently large and their distribution sufficiently wide, alternative videodisc catalogs may prove less expensive to produce than printed catalogs. The case studies that follow describe situations in which this or some other factor has warranted tests of videodisc cataloging. The first three studies deal with cataloging in a retail setting; the others, with industrial catalogs.

Case Study — Sears

In 1981, Sears Roebuck and Company produced a videodisc version of its general summer catalog for test distribution to 1,000 regular customers who owned Pioneer videodisc players. The disc contained 5,600 still frames and 17 motion sequences to display 17,800 items that would normally fill 236 printed catalog pages. The disc catalog cost $250,000 to produce, and half its cost went to lease still-frame editing equipment.

Sears currently prints 35 different catalogs per year at a cost of approximately $300 million, of which 90% is for manufacturing and distribution. According to Sears' Director of Catalog Advertising, the cost of a disc catalog begins to compare favorably to the cost of the printed version only when volume exceeds four million discs. The installed base of consumer videodisc players is not expected to reach this level until 1986 at the earliest (see Chapter 5).

The Sears catalog experiment was not deemed a success, primarily because finding any particular item on the disc was quite ponderous. This was largely due to the method of indexing, the number of items included, and the number of frames used to describe individual items, rather than limitations of the technology.

Case Study — American Express Travel Discs

American Express is reportedly experimenting with the creation of vicarious vacation tours presented on videodisc. Hotels and other tourist attractions would pay for space on the disc, which American Express plans to display in its storefront offices. The advantage to American Express is that a customer can be shown a potential vacation spot without tying up an American Express representative. The advantage to the resort facilities presented on the disc is their ability to get their advertising message directly to American Express travelers.

Transactional Catalogs

Transactional catalogs represent a more sophisticated version of disc cataloging than the preceding examples.

Chapter 1 defined Level 5 videodisc players as a Level 3 or 4 player serving as an element of a multi-point transactional network coordinated through computer-programmed control. One of the more commonly cited applications of such transactional networks is their use in videodisc kiosks which would not only offer product information but also allow consumers to place purchase orders through the kiosk. J.P. Stevens began testing such a transactional application in the Summer of 1983. "Electronic Bed and Bath Fashion Centers" were placed in seven major department stores. A center, which includes a videodisc player, computer, monitors for each, and a printer, allows customer to review the full Stevens product line. The kiosk takes customer orders and compares them to the retailer's stock. In-stock items are pulled from the retailer's inventory and out-of-stock items are ordered from Stevens' Greenville, South Carolina fulfillment center. The kiosk provides the customer with a printed copy of the order, which is taken to a cashier for payment.

Whether either consumers or retailers will accept such devices on a large-scale basis is a matter of much debate in the industry. Stevens estimates that 80% of the orders placed through its kiosks will be filled from the Greenville center, effectively bypassing the retail distribution arm. Many retailers see this as vendor encroachment on their clientele.

The next step in the development of such services is to bypass the cashier by utilizing magnetically encoded charge cards customers will insert into the kiosk. This would permit companies to set up kiosks in shopping malls rather than in retail outlets. But consumer and retailer reaction to such devices remains uncertain, and thus their likely growth is impossible to gauge. For this reason, transactional catalogs are not included in the forecasts of disc production which appear at the end of this chapter.

Case Study — Stock Photo Agencies

Stock photo agencies are in the business of supplying photographic images to publishers and advertising agencies for reproduction. A consortium of such agencies in New York is examining the feasibility of using interactive videodisc technology for an image previewing catalog. In the present previewing process stock photo agencies provide customers with trays of 25-50 slides, from which customers can select the slides that best fit their needs. Just keeping track of the disposition of various slide trays accounts for substantial agency overhead. Moreover, slides are highly susceptible to loss or damage during the previewing process.

The proposed interactive catalog would use videodisc as a repository for the images and a microcomputer equipped with floppy disc for indexing and accessing images. Customers could locate the images they need and the agency could ship only those images specifically ordered by the customer.

The consortium estimates that transferring images from 35mm slides to videodisc will cost 25-50 cents per image, not including replication costs. This is far less expensive than the most obvious alternative, a print catalog. Preparation of a page of eight full-color images for printing on high-quality paper costs $110, the consortium estimates. Thus, the pre-replication cost of a print catalog of 8,000 images is approximately $110,000, while a videodisc holding 50,000 images would cost $12,500-$25,000. And per volume replication costs for discs are lower than for 1000-page books on high quality paper. The plan is contingent upon the customers bearing the costs of videodisc and computer hardware necessary to use the catalog.

Case Study — Hotel Convention Catalogs

A similar "previewing" function is involved in the selection of suitable locations for corporate meetings and conventions. One company is currently assembling video presentations of major hotel convention locations on discs for placement in corporate travel departments. Each convention facility will be charged for the amount of disc space it uses, and corporate travel departments will pay a fee for the service.

Corporate travel departments typically rely on the recommendations of a travel agency in selecting convention and meeting facilities. The travel agent has often visited many convention facilities to gain first-hand knowledge, or has file descriptions of various facilities. In exchange for gaining such information, corporations book transportation and lodging through the travel agent.

The videodisc is intended to permit in-house examination of convention facilities by corporate travel departments. Additionally, transportation and lodging arrangements can be made without a travel agent.

Observations

The case studies identify two types of catalogs. The first type is a catalog published by manufacturer or distributor — like Sears or the stock photo agency — to promote its own products. The second type involves catalogs assembled by third parties — like the American Express catalog or the hotel convention catalog. The second type tends to be more promotional in nature. Manufacturers or service providers pay to be included in the catalog, so that the catalog becomes in reality an advertising medium. Videodisc versions of the first type are typically seen as replacements for print catalogs.

The growth of videodisc cataloging is closely tied to the availability of an installed base of players among the potential users of the catalog. This makes general merchandise catalogs like those of Sears or other mail-order houses unfeasible until a large installed base of consumer players develops. However, if either the seller or the buyer gains considerable advantage from the use of videodisc, the cost of acquiring the necessary hardware in order to access the catalog may be justified. Nevertheless, it is by no means clear that videocassette could not offer these same advantages at lower cost. Among the cases described here, only the stock photo catalog seems to offer clear-cut advantages over other alternatives.

Projections for Interactive Videodisc Cataloging

Interactive videodisc offers clear advantages over the other forms of cataloging in only a very limited number of cases. For this reason, BCG projects slow growth in this application through the end of the decade.

The Cataloging Market

Year	Projected Disc Production
	Titles
1984	5
1986	20
1988	80
1990	200

Source: BCG

Even if videodisc cataloging applications exceed these levels, production will largely involve the transfer of existing still frames onto disc — a largely mechanical process which will likely be dominated by large specialty houses able to invest in mass production facilities.

CHAPTER 4

THE EDUCATIONAL MARKET

Much of the pioneering research and development of interactive videodisc technology has taken place within educational institutions, and a great deal of what might be called "pure" R&D still goes on within this setting. (See p. VII-14 for a listing of colleges and universities currently involved in interactive videodisc research.) Many educationally-oriented interactive videodiscs have been produced in connection with this research. However, outside these R&D programs and associated tests, interactive videodisc technology has not entered American classrooms. The market for interactive videodiscs among educational institutions is practically non-existent now and will develop very slowly in the future. The chief reason for the dormancy of this market is the relatively static state of the broader educational market for mediated materials.

A. THE BROADER EDUCATIONAL MARKET FOR MEDIATED MATERIALS

The educational market for mediated materials includes spending by schools, colleges, and universities for books and audiovisual materials. Publishers sold over $3 billion in texts and other books to this educational market in 1982. Sales are projected to grow 8.6% per year through the end of the decade, exceeding $6.2 billion in 1990. This represents a significant slowdown from sales growth experienced through the 1960s and 1970s.

Educational Software Market

	Millions of Dollars* — Projected					
	1982	1984	1986	1988	1990	Annual Growth
Publishers Book Sales	$3234	$3770	$4494	$5292	$6232	8.6%
(Overall A/V Sales	570	593	617	642	667	2.0%)
Audovisual Software	143	148	154	161	167	
Total Software	$3377	$3918	$4648	$5453	$6399	8.3%

Source—The Wolfman Report on the Photographic Industry., BCG projections.

*All dollar amounts are in current dollars and reflect an inflation rate of 10%.

Current data on audiovisual expenditures in the educational market are not readily available. The most recent figures available show expenditures of $550 million for both hardware and software in 1980, about 0.5% lower than 1979 spending. The projections in the preceding table reflect a slow recovery through the 1980s paralleling that of book sales. Total audiovisual sales for 1982 are estimated to be $570 million, of which about 25%, or $151 million, was spent on software. A projected annual growth rate likely to be well below the current rate of inflation indicates that unit purchases of both hardware and software will decline slightly.

Despite the slow growth of the educational market for audiovisual equipment and materials, spending in the $600-700 million dollar range continues to take place annually, with about one-quarter going for software. Moreover, audiovisual spending seems to be shifting from 16mm film to video media. A survey of audiovisual users conducted by PBS Video in early 1982 found that better than 95% of schools and colleges owned videocassette recorders and roughly the same percentage owned 16mm projectors. However, in answer to a question concerning anticipated purchases, three-quarters indicated they intended to buy VCRs, while slightly less than half indicated plans to buy 16mm projectors. These survey findings correspond to trends discernible in industry reports of overall audiovisual purchases. Between 1979 and 1980 the only significant growth in spending for audiovisual equipment occurred in purchases of VCRs and televisions. It is reasonable to assume that purchasing by educational institutions conformed generally to this trend.

The anticipated slow growth of the educational market for both books and audiovisuals is linked to broad demographic trends. At the end of the 1970s, the last class of the baby boom generation graduated from college. Elementary and secondary schools saw their enrollments decline, dropping 6.3 million students between 1969 and 1979. Colleges and universities, who watched their enrollments grow by 50% through the 1970s, will lose 2% of their enrollment by 1990. Declining enrollment results in declining budget growth, which translates into less money for mediated material purchases. Moreover, the budget shrinkage brought on by declining enrollments is likely to be exacerbated over at least the next 3-4 years by decreasing government support of educational institutions.

Interactive videodisc has demonstrated potential as an educational tool. However, declining enrollments have pushed down educational institutions' expenditures for all types of mediated materials, and high-ticket items such as interactive disc systems are likely candidates for budget cutting.

B. THE CURRENT STATE OF INTERACTIVE VIDEODISC IN THE EDUCATIONAL MARKET

Although the bulk of research and development work on interactive videodisc applications has come from educational institutions and has produced numerous discs directed toward educational applications, at this point there is practically no market for interactive videodiscs among educational institutions. The current installed base of videodisc players in schools and colleges probably amounts to no more than a few hundred machines nationwide. Nevertheless, some indications of the way in which the educational market is likely to develop can be drawn from the current thinking and activities of disc producers and others familiar with the market.

Case 1 — The CPB/Annenberg Interactive Videodisc Science Instruction Project

The Interactive Videodisc Science Instruction project is a recently completed educational application of interactive disc funded by The Annenberg School of Communications and CPB and produced by the Nebraska Videodisc Design/Production Group and University of Nebraska-Lincoln's science departments. The three-disc set contains 6 laboratory experiments for introductory college-level physics, biology, and chemistry and is currently being tested in a number of universities. It is designed to be highly interactive, utilizing an outboard microcomputer to both control the videodisc and generate graphic overlays of visual images stored on the disc. The system allows students to perform complex experiments, guiding the process through the computer keyboard and seeing results by means of images stored on the disc. A set of experiments in the physics of motion involve video sequences of gymnastics from which the student is asked to calculate linear and angular momentum, gravitational potential momentum, etc. A biology disc enables the student to alter the temperature and pressure to which various organisms are subjected in order to study the effects of these environmental factors on respiration. A chemistry disc shows the student video sequences of chemical reactions, from which he or she is asked to identify the type and quantity of the chemicals involved. The producers of the set hope tests will show that the disc-based experiments are a more effective learning mechanism than traditional freshman-level hands-on labs.

Case 2 — SPACE DISC

Video Vision Associates, Ltd. of New York markets a set of six educational videodiscs produced by The Center for Aerospace Education at Drew University. Entitled SPACE DISC, the set contains both still frames and motion sequences taken primarily from various NASA missions and is promoted as suitable for use at all educational levels from kindergarten through post-graduate. The first disc was available in mid-1982, and the full set will be completed by November 1983.

SPACE DISC is an archive of a vast number of images. There is no continuous audio narrative, the instructor is provided with a 110-page printed guide to the contents of each disc but not with a script.

The built-in interactivity of the discs is limited to a table of contents and chapter stops. The discs are designed for use with Level 2 videodisc players, i.e., those with scanning, fast forward, and random frame access capabilities. However, promotional material notes that they can be controlled by an outboard microprocessor for use at higher levels of interactivity.

The discs are priced at $320 each, or $1600 for an advance subscription to the full set. According to William Clark of the Center for Aerospace Education, by May 1983 the discs had attracted 300 buyers, of which 150 subscribed to the full set. Revenues from the disc are estimated to exceed $290,000. Clark reports that the project has recouped the investment to produce and market the set, indicating that the cost of bringing one of the discs to market was approximately $50,000. Because production involved a relatively straightforward transfer of linear material onto the disc, much of these costs were incurred in the process of collecting material from various sources.

According to Clark, 99% of the disc's customers use it as a classroom audiovisual aid to illustrate lectures or provide material for classroom discussion. Video Vision has recently introduced an interface which allows instructors to record the narration for a presentation on audio tape while at the same time imbedding instructions to the disc player in the soundtrack. Using this device, the teacher can custom-tailor a presentation and re-use it from year to year. Video Vision plans to offer prerecorded narration for the SPACE DISC set using this device. Each disc will serve as the visual material for a number of prerecorded presentations for each grade level.

The small installed base of videodisc players among educational institutions has already been noted. In marketing SPACE DISC, Video Vision has attempted to overcome this problem by offering a package of the SPACE DISC set and a Pioneer 8210 videodisc player. The player, equipped with remote control, is offered for $795 if purchased with the SPACE DISC set, or $845 if purchased independently.

Clark believes that the present base of customers is a small fraction of the potential market. Those buying the discs now tend to be educational innovators, Clark said, but he expects exponential growth of the educational market for videodisc beginning in two to three years. The market, in his opinion, will be for discs like SPACE DISC, which function as a traditional audiovisual medium in the classroom. According to Clark, Video Vision plans to bring 12-15 additional science and mathematics discs to market in the next 12 months.

Observations

SPACE DISC has enjoyed some success in the marketplace; however, this case should not be too quickly generalized. The space sciences, SPACE DISC's primary market, have traditionally relied on visual material to a higher degree than other disciplines. Moreover, most of the material incorporated in SPACE DISC is unavailable in any other form; the project was initiated in part because NASA wanted to find a medium through the visual record of its space missions could be made available to the public. Although sales of SPACE DISC neared the breakeven point on production costs after one year of marketing, it is unlikely that the level of sales it has produced will be enough to make the market attractive to many commercial producers. The cost of producing SPACE DISC was relatively low. The material, though dispersed geographically, was already available on other visual media. Production involved simply transferring the material onto videodisc, a much less expensive procedure than actually shooting new film.

Videodisc offers a particularly flexible audiovisual medium. A single disc can hold a vast number of images in various formats — slides, still photos, films, filmstrips, maps, text, graphs, and so on — which can then be accessed in any order to produce a custom-tailored presentation. But the attempt to sell videodisc into the educational market faces a chicken-and-egg problem. A large library of educational videodiscs is needed if schools are to justify investing in videodisc players, yet videodisc producers depend on a large installed base of players to ensure a return on their investment. Other media are already well established in schools and colleges, and offer the user access to an almost limitless array of material.

A set of laboratory discs like those produced in the CPB/Annenberg science project might present one way of getting around this problem — that is, selling interactive videodisc systems, complete with hardware and software. A small college might be interested in purchasing two or three copies of a disc set which encompassed a full set of lab experiments in support of a chemistry course, along with the necessary hardware, if it could reduce costs significantly without sacrificing educational value.

The processes underlying the CPB/Annenberg discs — the forming and testing of hypotheses, and induction from observations — are applicable to other fields, such as the social sciences. Ultimately, the use of videodisc-based laboratories could support courses in a number of academic departments, in the same way that language laboratories consisting of audiocassette machines and headphones support all the language departments in a university.

A number of caveats must be made with regard to this scenario. First, it is probably limited to the college and university market. The high school environment would typically need at least one player for every two or four students, raising the necessary outlay for hardware to prohibitive levels. Sales of such learning systems into the elementary and secondary school market will probably need to focus on areas where individualized instruction is well established, e.g., remedial education.

Perhaps the most significant variable influencing the development of a market for laboratory discs — the willingness of educators to accept interactive videodisc laboratories as a useful tool for teaching — is highly unpredictable. Educational institutions are widely seen as conservative with regard to new techniques, though this may be less the case in the sciences than in other disciplines.

Another issue involves the willingness of educational institutions to invest significantly in hardware dedicated to a limited function. As the market for mainframe computers developed, for instance, colleges and universities were more apt to invest in computers with less elegant operating systems which had a wide applicability rather than more efficient systems of limited scope. Thus, while IBM sold large numbers of elegant dedicated systems into the business sector, DEC appealed to the educational market with its more cumbersome multi-purpose systems. Educational institutions may be more inclined to invest in the hardware for laboratory discs if the microcomputer and disc player are generalized enough to be used for other purposes.

Finally, laboratory discs do not completely escape the "chicken-and-egg" problem. Colleges and universities will be more likely to invest in the necessary hardware if it offers them access to a relatively large library of experiments in a number of disciplines. The minimum offering necessary to persuade schools to invest in videodisc laboratories should probably cover the lab work for an entire introductory course. This could easily require a dozen separate experiments, or six discs — which would in turn represent no small capital outlay for a producer entering an uncharted market.

These caveats taken together represent a significant impediment to the development of the market for videodisc-based laboratory systems (or other learning systems) among educational institutions.

C. VIDEODISC AND PERSONAL COMPUTERS IN THE EDUCATIONAL MARKET

A number of educators interviewed by BCG commented on the relationship of the educational market for personal computers to the potential educational market for interactive videodisc. A commonly-voiced opinion was that any funds in school budgets that could conceivably be spent for videodiscs were being spent instead on personal computers. Thus the popularity of personal computers is, paradoxically, an impediment to investment in videodisc. Another group of interviewees, while not disputing this state of affairs, felt that the videodisc player would soon become a standard computer peripheral, so that the present educational market for computers would ultimately spawn a market for videodiscs.

Educational institutions are definitely acquiring desktop computers at a rapid rate. International Data Corporation estimates that by year-end 1982, elementary and high schools were using 274,000 desktop computers, and projects an installed base of 1 million units by 1986. However, the use of computers in schools faces some immediate problems, according to a recent Wall Street Journal report. Schools have tended to rush into hardware purchases without first adequately assessing the way in which the machines will be used in the educational curriculum — sometimes without even reserving funds for software purchases. Teachers are often not equipped to utilize the new technology, and the actual use of machines is thus often quite limited.

A central issue that appears to remain unresolved by many school administrators is whether they intend to use computers to teach students how to use computers or as equipment for computer-aided-instruction in other subjects. Such problems are producing some disillusionment with and caution towards computers among teachers and school administrators. The major small computer manufacturers will likely be quick to find and fund ways of getting around these problems — through teacher computer training and consultation services for school systems — since schools represent a major market themselves and their acceptance of computers spurs the development of the home market. However, the fund of "bad experiences" that is being built up in the educational system may result in some resistance to the introduction of another new technology — videodisc — linked to computers.

Another issue in the "videodisc-as-computer-peripheral" scenario is the question of precisely what sort of peripheral the disc player represents. If it is conceived as an image storage device to augment CAI, this scenario is little different than the "systems approach" discussed earlier. However, videodisc also represents a storage device that many industry observers believe will ultimately replace magnetic media (e.g., floppy discs) currently used for data storage with computers. This application of videodisc depends upon a number of technical developments, namely, digitally-encoded videodiscs which can store information in a form usable by the computer, discs that can be "written" onto and then read by the computer (commonly called DRAW discs, for "Direct-Read-After-Write"), and finally, erasable discs. Each of these technologies has been developed and recently brought to the marketplace in one form or another. But each is currently extremely expensive — for instance, Matsushita's recently announced electronic filing system employing erasable disc technology is expected to sell in the $70,000-$90,000 range. The company says that it will be 5-8 years before the technology can be delivered at a price appropriate for the consumer market. The time frame for the development of the educational market for such applications can be expected to be similar. If videodisc enters the schools primarily as a computer peripheral, its entry is likely to be substantially delayed.

D. THE DEVELOPMENT OF THE EDUCATIONAL MARKET FOR INTERACTIVE VIDEODISC

The market for videodisc in the education market should develop along two trajectories: one epitomized by SPACE DISC; the other, by the CPB/Annenberg science discs. A continuing flow of materials like SPACE DISC, which serve strictly as classroom audiovisuals or "electronic blackboards," can be expected. Perhaps 8-10 titles will be produced in 1984, growing to 40-50 titles by 1986. These discs will have limited interactivity and will be played on consumer-level players.

The development of more complex interactive courseware like the CPB/Annenberg laboratory series will require funding from government or private foundations. Initial marketing will probably require selling hardware/software packages, until enough hardware is in the field to support software-only sales. Both these factors mean that growth will be slow. However, international sales into countries not experiencing declining enrollments may increase the potential for profitability. The table below shows BCG projections for the market for both types of educational disc.

Educational Market

Year	Projected Disc Production	
	Audiovisual Titles	Interactive Titles
1984	10	4
1986	45	12
1988	175	40
1990	800	200

Source: BCG

BCG anticipates steady growth for audiovisual discs. Laboratory discs, on the other hand, will develop much more slowly. The introduction of videodisc-based home videogames, expected in 1987 (see Chapter 5 for discussion), should create sufficient revenues from the consumer market to support higher-risk forays into the educational market by videodisc producers and hardware manufacturers. This activity will begin to generate a sizable market for highly interactive coursediscs in 1989 or 1990.

CHAPTER 5

THE ENTERTAINMENT MARKET

The major existing consumer market for videodiscs is an entertainment market. It is dominated by linear feature film discs and the CED videodisc format. Although the consumer market has not developed as quickly as manufacturers expected, it shows potential for continued moderate growth. However, interactive videodisc is not a part of this entertainment market, nor will the continued growth of the market provide an entry for interactive entertainment discs. That point of entry will come from an entirely different quarter — the development of interactive disc-based video games.

A. THE BROADER MARKET FOR ENTERTAINMENT

The domestic entertainment market is large and amorphous — even when confined to "mediated materials." In order to assess the size of this market, BCG included the revenues of those forms of entertainment software with which videodisc can be expected to compete more or less directly. These include theatrical motion pictures, cable television, other subscription television (STV, MDS, DBS), audio recording, video game software, and pre-recorded videocassettes.

The following table shows revenues in these categories for 1982 and revenue projections to 1990. The figures given are based on a survey of standard sources of industry statistics and projections.

Entertainment Software Revenues

Medium	Millions of Dollars*— Projected					
	1982	1984	1986	1988	1990	Annual Growth
Box Office Gross[1]	$3453	$4012	$4663	$5418	$6297	7.8%
Cable and Subscription TV[2]	$4869	$7956	$11543	$15251	$18697	18.3%
Audio Recordings[3]	$3508	$3648	$3946	$4268	$4616	3.5%
Video Game Software[4]	$1500	$2043	$2782	$3789	$5160	16.7%
Pre-recorded Videocassettes	$ 371	$ 454	$ 877	$1349	$2074	24.0%
Total	$13,701	$22,186	$23,811	$30,750	$45,446	13.2%

Sources:

[1] Motion Picture Association of America/BCG
[2] Paul Kagan Associates/BCG
[3] Recording Industry Association of America/BCG
[4] Video Marketing Game Letter/BCG

*All dollar amounts are in current dollars and reflect an annual inflation rate of 10%.

The table does not include videodisc data, since this will be discussed in detail in the section immediately following. Entertainment software revenues in 1982 were nearly $14 billion, of which about 50% went to the various forms of video entertainment. Revenues are expected to grow by 13% annually, reaching over $45 billion by 1990. Revenue growth in the entertainment market will be driven largely by increased expenditures for video media (cable and subscription television, videocassettes, and videogames), as a variety of new technologies continue to increase the importance of the television set as the focal point of entertainment in American homes. Video media are expected to account for over 57% of market revenues by 1990. Within this category cable and subscription television are expected to take more than 72% of the total market, while videogame software will garner 20% and pre-recorded videocassettes will account for about 8% of dollars spent.

An important caveat must be registered regarding the projected totals in the preceding table. The projections for each of the line items are based on historic trends. As penetration of the market by the various video media grows, and the market becomes saturated, the competition among these media will become more intense than in the past. This competition will result in some cannibalization of the market for video, potentially reducing the growth rates of some or all video media. Thus the overall growth of revenues in the market may fall below the projected annual rate of 13%.

B. THE FUTURE OF VIDEODISC IN THE ENTERTAINMENT MARKET

Videodisc's future as a medium for delivering entertainment to consumers has two components: the continued growth of linear videodisc as a medium for feature films and other linear programming, and the development of interactive videodisc games and the subsequent interactive programming this development will support.

Factors Influencing the Growth of Linear Videodisc

Since its commercial introduction videodisc has spawned endless forecasts of its future within the entertainment industry. Its imminent demise was proclaimed by many observers in mid-1982, but their eulogies were apparently premature. The New York Times estimates that there were some 305,000 disc players in American homes by the end of 1982, more than half of them in the CED format. RCA expects the installed base of CED players to reach 500,000 by the end of 1983 and then to triple by year-end 1984.

Analysts often use the growth patterns of other electronic media in the years immediately after their introduction to project the future growth of videodisc. This procedure is questionable, however, because no other medium provides a close analogy. Videodisc does not represent a wholly new medium as radio and television did when they first came to market. Phonographs represent a similar medium, in that they are a "playback-only" mechanism. But when phonographs were introduced audiotape was not yet available, while consumer videotape machines preceded videodisc in the marketplace.

A number of factors will inhibit the growth of videodisc as an entertainment medium in the next few years, chief among them competition from other video media — particularly VCRs. The price of VCRs has dropped over the last two years, and this trend can be expected to continue. The expected introduction of one-quarter-inch home VCRs in 1986 will further reduce prices. The fact that VCRs can record programming off-air puts videodisc at a great disadvantage, a disadvantage overcome thus far only by extremely competitive pricing. Technology which would allow home recording on discs is being developed, but manufacturers will probably not be able to price this technology at a level competitive with VCRs. Laser videodisc playes are currently priced at the low end of the VCR price range, but adding the features necessary to compete with VCRs — including a television tuner and a small microprocessor for presetting recording times — will dramatically increase the price of the machines.

Videodiscs are now $30 cheaper than the average pre-recorded videocassette, giving videodisc an edge in software sales. But pre-recorded videocassettes can be rented at very low rates and thus are more than competitive with videodisc software. The small installed base of disc players makes the emergence of a rental disc market unlikely in the near future, and disc manufacturers will devote a great deal of effort to preventing the development of a rental market.

The continuing growth of cable and subscription television, along with the possible introduction of DBS in 2-3 years, will diminish the portion of disposable income consumers can devote to home video. Moreover, the large number of channels available with cable may increase the need to time-shift viewing and thus encourage VCR purchases. Cable offers no such boost for videodisc. Although manufacturers claim that videodisc player penetration is high among cable owners, this phenomenon is probably temporary. It reflects a larger proportion of "innovators," who are the first to buy new technology, in the cable population. These factors will combine to retard the growth of linear videodisc as an entertainment medium.

The Introduction of Interactive Videodisc Games

One development, expected in 1986-1987, has the potential to create an extremely large entertainment market for interactive videodisc — namely, the introduction of videodisc-based home video games. Present home video games, which utilize computer-generated graphics, were developed after the introduction of arcade video games; Cinematronics released the first disc-based videogame, Dragon's Lair, to arcades in July 1983. BCG research indicates that at least six other major companies are currently involved in the development of videodisc-based arcade games, including Atari, Lucasfilm, Sega Enterprises, Sente Technology, and Laser Disc Computer Systems. Bally Manufacturing Company, though apparently not developing a disc-based game, is actively seeking to license or buy and market technology developed by others. Laser Disc Computer Systems, a Boston company formed specifically for the purpose of producing such games, plans to introduce its first game, "Eon and the Time Tunnel," in August, 1983.

The development of disc-based games has centered on resolving technical issues — particularly on the problem of reducing the random frame access time of players in order to provide the "seamless" fast action typical of current video games. The Cinematronics game, though it features Disney quality graphics, fails to provide "seamless" action; at some branch points in the game the screen goes blank for a few seconds as the machine scans the disc for the next video sequence. The game developed by Laser Disc Computer Systems uses two disc drives linked in a manner developed by the Architectural Machine Group at MIT to solve this problem. Sega reportedly plans to use high-speed disc players under development by Pioneer and N.V. Philips, and recently placed a firm order for 10,000 videodisc machines with Pioneer of Japan. It is generally thought that each videodisc arcade game could generate a demand for 5,000-10,000 players. The initial purchase of arcade videodisc consoles is expected to cost dealers about $4,000 — about $500 more than the price of existing top-of-line arcade games. The use of videodiscs, however, will in some instances make it possible for dealers to change the game in a console simply by changing discs, rather than trading in the console itself. Replacement discs are expected to sell for around $1,000. Moreover, the more realistic video made possible by videodisc will give arcade operators an opportunity to raise their per game price to fifty cents, a move that has already been made for some more complex arcade games.

A spokesman for one disc player manufacturer interviewed by BCG predicted that videodisc-based games would reach the home market 2-3 years after their introduction in arcades, an opinion generally held in the industry. The hardware requirement for home videodisc games is a matter of speculation at the moment. Manufacturers may utilize an enhanced version of the on-board microprocessor currently incorporated in the more sophisticated consumer and industrial players. If, on the other hand, an outboard computer is used, disc players will probably be packaged with computers or with interfaces for the more popular personal computers. Whatever specific hardware is required, the development of home videodisc games is almost certain to result in the rapid development of a massive installed base of videodisc systems capable of a high level of interactivity. The existence of this installed base will in turn create a very large potential market for non-game interactive videodiscs (as well as expand the linear disc market).

C. GROWTH OF THE ENTERTAINMENT MARKET FOR VIDEODISC

The table below forecasts the development of the entertainment market for videodisc through 1990. It incorporates the assumption that interactive home videodisc games will be introduced in 1986 and that the videodisc game market will develop rapidly, though not quite as fast as the computer video game market in the first five years after introduction (i.e., 1979-1983). Videodisc games, unlike home computer video games, will be entering a pre-existing market with established competition (i.e., computer video games).

Entertainment Market

Year	Videodisc Growth	
	Installed Base (thousands)	Software Revenues (millions)
1983	470	$235
1984	1,800	$720
1986	4,500	$2,079
1988	9,000	$5,246
1990	15,000	$6,750

Source: BCG

These revenue projections are based on a $20 retail price for linear videodiscs beginning in 1984 and a $60 price for interactive game discs once they are introduced in 1986. Average game disc prices can be expected to drop as their novelty wears off and prices on older discs are lowered, just as the average computer video game cartridge price has come down over the last year because of a broader mix of pricing levels. The average game disc is projected to cost $50 by 1988, and $40 by 1990.

The revenues projected here would give videodisc a 12% share of total entertainment software revenues in 1988, rising to 13.7% in 1990. Obviously, this is a very optimistic scenario. Should interactive videodisc games be introduced later, or should the market for them fail to develop at a rapid rate, the overall growth of videodisc will be significantly slower. Without videodisc games, the installed base of players will likely not exceed 5 million by 1988, and software revenues will be reduced to $2 billion. More importantly, barring the development of interactive disc games, no significant entertainment market for interactive videodisc can be expected before the end of the decade.

CHAPTER 6

THE PUBLISHING MARKET

The most pervasive medium in the modern world is, obviously, the printed word. This chapter discusses the publishing market apart from its involvement in publication sales for the training and educational markets discussed in previous chapters. Among the potential markets for interactive videodisc, the publishing market is likely to be the slowest to develop — except in relatively isolated applications. The major U.S. publishers are watching the development of videodisc (and other electronic media) closely, and warily. They are not, however, investing in the development of videodiscs to any significant degree.

A. THE BROADER PUBLISHING MARKET

Publishing revenues were approximately $10.1 billion in 1982, excluding revenues from the educational and training markets. Of this total, $4.1 billion was from book sales, $4.4 billion from periodical sales, and $1.5 billion from microforms (microfilm and microfiche) sales. Projected market growth at an estimated annual rate of 10.8% will bring the market to a level exceeding $23 billion by 1990.

Publishing Revenues

Medium	Millions of Dollars* — Projected					
	1982	1984	1986	1988	1990	Annual Growth
Books	$4,156	$5,307	$6,838	$8,556	$10,718	12.6%
Periodicals	$4,452	$5,131	$6,019	$7,047	$8,265	8.0%
Microforms	$1,553	$1,975	$2,511	$3,190	$4,053	12.7%
Total	$10,161	$12,413	$15,368	$18,793	$23,036	10.8

Source: Book Industry Study Group

*All dollar amounts are in current dollars and reflect an annual inflation rate of approximately 10%.

It is generally accepted that the rapid growth of video media described earlier in the entertainment market will have, if it has not already had, a detrimental effect on the growth consumer of sales of both books and periodicals. The 10.8% real dollar annual growth rate projected in the table above reflects constant dollar growth of only about 3% per year. This rate is based on historic growth over the last three years, a slower growth period than was typical during the 1970s, and takes into account competition from video media.

B. THE STATUS OF VIDEODISC IN THE PUBLISHING MARKET

Interactive videodisc's current share of the publishing market is negligible, although some isolated applications are being marketed. Obviously, movies are in one sense a form of published material, and a market exists for movies on videodisc. Feature films comprise about 75% of currently offered linear videodiscs. Concert discs and other musical formats account for another 10-11%, while the remaining titles range among children's programming, opera and theatre, documentary and instructional materials, and sports. In the language of the publishing industry one could say that a small market for non-fiction and children's literature has begun to develop among videodisc owners. But major U.S. book and periodical publishers have not invested significantly in developing videodiscs for any market. The study that follows examines why this is the case.

Case Study — Houghton Mifflin

Houghton Mifflin explored the possibility of marketing a videodisc version of one of its more popular non-fiction titles, a field guide to birds, which has sold three million printed copies. For a number of reasons the guide was felt to be an appropriate title for a pilot project exploring video publishing. Video presentation of the material enables a closer and more naturalistic inspection of the birds and their habitat, as well as their songs. The video version was planned as a complement to the printed version, rather than a replacement for it.

A joint venture was formed with Boston Broadcasting/Metromedia, which handled the video production. A videocassette version of the field guide is currently being marketed, but plans for producing a videodisc version have been shelved indefinitely. Despite Houghton Mifflin's strong belief that interactive videodisc was the optimal video medium for the material, the publisher felt the installed base of players in the consumer market to be too small for the disc investment to break even.

A second Houghton Mifflin video project involves a joint venture to produce two major series, one on the subject of American government and another on the human mind. Houghton Mifflin has entered both with an expectation of profit, and intends to use a full gamut of video media for distribution of the material: public broadcasting, commercial television, videocassette, videodisc and print. The home video marketing of these products is expected to commence 3-5 years after they are broadcast. If the publisher finds that a market exists, videodisc will become part of the home video segment of the marketing plan. The print, videocassette, and videodisc products will also be marketed to educational institutions.

In addition to its exploration of video media, Houghton Mifflin recently became involved in computer-based electronic publishing through the acquisition of Tymeshare Corporation, a New Hampshire-based computer software production firm. Tymeshare principally produces 550 individual floppy-disc titles for the recent generation of 16-bit microcomputers. Their initial market is among educational institutions, but Tymeshare plans eventually to move into the consumer market for floppy disc computer software.

Observations

Houghton Mifflin's approach to electronic and video publishing appears to be fairly typical of many print publishers. The company is very interested in the potential markets offered by new technologies and is exploring alternative media. However, it will not commit substantial capital in either area without a rather firm assurance of profits. Reader's Digest, on the other hand, has recently built a video studio to produce internal corporate communications and to test and explore new video products. Reader's Digest publishes an extensive line of "how-to" books containing visual materials which would easily lend themselves to videodisc conversion. A spokesman for the publisher said that a test videodisc based on the "how-to" illustrations might be produced within the next year. However, the company has no near-term plans to make a signficant entry into videodisc publishing — again because of the small installed base of consumer players.

Generally, the publishers interviewed by BCG saw videodisc as both a threat and an opportunity — though an opportunity some years down the road. Print publishers fear encroachment on their established markets through the production of videodisc material by entities that have not traditionally served those markets, such as television networks and Hollywood film studios. On the opportunities side, videodiscs are viewed as a natural extension of the print business, with the potential to both complement traditional print products and offer new types of products to existing and new markets.

Publishers frequently noted that they have established relationships with the most important single resource for publishing — the creative and intellectual communities. They felt this was in sharp contrast to the resources involved in the production of popular television series and Hollywood movies. This point is particularly interesting in light of the comments of another BCG interviewee — the president of a major videodisc player manufacturing company — who said that the long-term interests of the videodisc industry would not be served through investment in "Hollywood-type" material. He noted that motion picture producers deal in perishable commodities and therefore must squeeze every possible dollar out of a product as quickly as possible. In line with these views, the manufacturer has begun to establish relationships with major opera and ballet companies with an eye toward making program investments.

Because videodiscs are seen to represent both potential competition and potential profit, traditional publishers are tracking the development of the videodisc industry closely. However, the concensus opinion is that the installed base of consumer players is not yet large enough to make videodisc publishing an attractive investment. The emergence of a publishing market for interactive videodisc, like the entertainment market, will await the development of a large installed base of interactive hardware. Thus the publishing market, like the entertainment market, will probably emerge only after the introduction of home videodisc games.

C. ARCHIVING APPLICATIONS FOR INTERACTIVE VIDEODISC

Another form of publishing generally thought to represent a potential market for interactive videodisc is the publishing of microforms, a category which includes both microfilm and microfiche. Microforms generated revenues of nearly $1.6 billion in 1982, and, moreover, these revenues are expected to increase at a rate faster than that of periodicals. Videodisc is an appropriate technology for this market because it offers random access to a storage area of 54,000 images per disc side. This storage capacity exceeds those of either microforms or standard magnetic media.

In April 1983, Matsushita announced plans for U.S. marketing of an "optical document file system" which takes advantage of the storage capacity of optical videodiscs. The system, which is expected to sell for $70,000-$100,000, also marks the first application of Matsushita-developed technology which permits the user to both store information on and erase it from a videodisc. The system uses eight-inch optical discs which can store up to 10,000 letter-sized documents. The documents can also be transmitted to remote locations through the use of an interface and a standard fascimile reproduction device.

Despite Matsushita's apparent confidence in the market for this type of videodisc application, however, two other major companies who had been exploring similar applications — Eastman Kodak and 3M — both announced in April, 1983, that they would not market disc archiving applications within the next three to five years. Both companies are significant participants in the microforms industry.

Pergamon International Information Corporation is currently involved in another application of interactive videodisc within the archiving market — a system designed to support patent searches. The system, labelled PATSEARCH, consists of a Z-80-based microcomputer with monitor, an off-the-shelf industrial videodisc player fitted with an onboard microchip, and a television monitor. The microcomputer is used as a terminal to access a database of U.S. and international patent information, as well as to control the videodisc player. Videodiscs supplied with the system contain the front-page drawings of patents filed with the U.S. Patent Office from 1971-1981. Patent searches can be conducted through a number of indices associated with the on-line database. Once a patent is located, the videodisc player moves to the disc frame holding the illustration for that patent. At the command of the user, the illustration is displayed on the video monitor. Searching can also be done through scanning the video images, and then accessing the appropriate information in the database. The system has been available for a $10,500 annual fee on a lease basis since February, 1982. A unit is also installed in the Public Search Room of the U.S. Patent Office in Crystal City, Virginia.

Pergamon decided to use videodiscs in the PATSEARCH system because of a need for fast random access to a vast number of images. Patent searches are typically conducted through the scanning of front page drawings. According to the systems' developer, PATSEARCH represented an appropriate employment of videodisc technology particularly because of the visual component involved in the task. The archiving of verbal material, on the other hand, might be more appropriately handled by other media; and, in fact, PATSEARCH uses a computerized database for verbal material. This fact can be generalized: present videodiscs are particularly efficient mechanisms for the storage and retrieval of visual material; however, the limited resolution of present video monitors may make them less than optimum vehicles for the archiving of print.

A number of other applications which attempt to capitalize on videodisc's advantages as an image archiving tool have been suggested or tested. Museums, for instance, are recognizing that interactive videodisc is an appropriate medium for establishing an easily-accessed record of their collections. The Boston Museum of Fine Arts has produced a test disc containing images of some collection items. It has been suggested that motion picture and television producers might find videodisc useful in maintaining a record of their products.

One factor retarding the use of videodisc in long term archiving applications is uncertainty about the usable life span of videodiscs. It has been established through testing and actual application that film-based archiving media are capable of storing data over long periods of time without significant deterioration, but there is no corresponding data for videodiscs. Although optical videodiscs in theory should be a very stable archiving medium, no one has stored an image on a videodisc long enough to measure long-term effects.

Because of the high cost of short-term archiving applications for videodisc (like Matsushita's file system) and the uncertainty surrounding the use of videodisc for long-term archiving, the market for videodisc archiving will develop slowly. When and if it develops, moreover, this application is not likely to generate great demand for traditional production services or design and analysis services. The process of transferring either visual images or print from existing media to videodisc is essentially a mechanical, assembly line task. Thus, archiving will generate little demand for the type of skills and services the public broadcasting system is best equipped to provide.

D. PROJECTIONS OF DISC PRODUCTION BY AND FOR PUBLISHERS

The publishing market for videodisc and interactive disc will develop slowly — more slowly than any other market analyzed in this report. The low installed base of videodisc players in American homes is the chief impediment. Nevertheless, publishers can be expected to produce a handful of pilot discs (perhaps 5-10 per year) until the installed base reaches a point that justifies their entry. These pilot discs will be an attempt by publishers to:

- learn videodisc technology and procedures,
- position themselves for entry in case the industry develops,
- promote themselves to authors and the investment community as aggressive and forward-looking, and
- exploit particular book properties which have potential in the videodisc market despite the low installed base.

As the installed base of players attains levels that can offer publishers a reasonable expectation of return on investment, they will gradually enter the market. The first videodisc "books" will probably have very low interactivity — a table of contents and chapter stops — and will be playable on all machines of a given format. Publishers will want to keep production costs low and address the broadest possible market.

An installed base of perhaps one million players in one of the formats (CED or LV) should be sufficient to bring publishers into videodisc production with certain types of books that have wide appeal — e.g., cookbooks, home or auto repair manuals, and self-help titles. This projection is based on widely held conviction that 25,000 disc sales are necessary for break-even on a larger disc production, and that non-feature film discs might find a market among 2-4% of those who own players of the format used. Assuming that the average disc sells for $19.95-$24.95, and that 50% of the retail price goes to distributors while 15% represents manufacturing costs, then the retail sale of a single disc contributes $7-$8 towards recovering fixed costs. Production and mastering for a large disc project is expected to cost $75,000-$150,000; and advertising and promotion about the same. Given these parameters, a disc at the low-end of the scale will have to sell 21,000 copies to reach break-even, while a high-end disc must sell more than 35,000 copies. If the publisher decides to offer discs in both formats, the necessary additional premastering, mastering, and replication would add approximately $40,000 to fixed costs and thus require an additional installed base of 200,000 players in the second format.

At current growth rates, the installed base of CED players will top the one million mark sometime in 1984 and reach 1.5 million by year-end. This suggests that 1985 may see 10-15 "how-to" books of the type mentioned above brought to market in videodisc form. The table below gives projections for the development of the market.

Publishing Market

Year	Projected Disc Production Titles
1984	7
1986	30
1988	75
1990	200

Source: BCG

These figures do not take into account, however, the potentially rapid growth of an installed base of highly interactive videodisc players fostered by the development of consumer videodisc-based games. A base of these machines large enough to warrant the attention of the publishing industry can be expected by 1988. Producing programming for these machines will represent a particularly challenging task for both the publishing and entertainment industries. Moreover, the programming developed is likely to blur the lines between the publishing, entertainment, and home education markets and industries.

CHAPTER 7

THE INTERACTIVE VIDEODISC INDUSTRY: PRESENT AND FUTURE

Previous chapters of this study have surveyed the interactive videodisc business from the perspective of the customers and markets it serves. This chapter focuses on the business of designing and producing videodiscs as it currently exists and is likely to evolve.

Today's videodisc design and production industry is in a very early stage of development. The structures, missions, and policies of companies active in the business vary dramatically. Specialization among the videodisc production companies is limited, and many producers seek any and all interactive videodisc work available. Clients have regarded interactive videodisc productions as expensive and risky, and have often become closely involved in the design and production stages in order to reduce financial risk. As a result, clients have become sophisticated about interactive disc design and technology, and the line between disc production company and client is often ill-defined. The keys to success in the industry have largely been close ties to the customer and a demonstrable track record in interactive disc design and production. At this early stage of the industry, the lowering of risk is more important than competitive pricing.

However, a variety of factors, largely of a market nature, will force clarification of the industry structure. First, as more companies become experienced in the purchase and use of interactive videodiscs, the decision to commission a disc will be moved out of the hands of senior line managers and corporate development executives and into conventional purchasing departments. At the same time, the risk associated with commissioning a $50,000 or $100,000 videodisc will be seen as diminished. The close relationships between disc producing companies and their clients are likely to become less significant as purchasing departments open the doors to competitive bidding.

As interactive disc usage becomes more common price competition among disc designers and producers will increase. The expansion of the customer base and the need to compete on the basis of price is likely to result in the creation of specialized disc design/production firms. Such firms could be expected to offer faster turnaround, resulting from greater familiarity with the task, and decreased cost, in much the same way that any service organization benefits from specialization. To understand where the design and production industry is going it is useful to take a detailed look at where it is today.

A. THE VIDEODISC PRODUCTION INDUSTRY: ORGANIZATION AND REVENUES, 1983

The design and production of videodiscs is a business still in its infancy. Physically it is growing quickly, but its personality has yet to develop. What it will look like in maturity is difficult to predict. Because the demand for disc design and production services is still uneven and unpredictable, organizations trying to base a business on interactive disc closely guard their client list, the details of their work, and their price structure. Therefore reliable information about them is hard to come by.

The nature of the business itself, that is, the fact that it is based on video production, means that anyone with video production capability can attempt to enter the market — television stations, commercial houses, in-house corporate audiovisual departments, etc. — if they can find a buyer. The low barrier to entry has resulted in scores of entrepreneurs setting up videodisc production shops. Many of these fail — two, including the fairly well-known Vision Machine Research, during the course of this study — but their presence complicates any picture of the industry's structure.

All these factors combine to make sorting out the structure of the interactive videodisc design and production industry a difficult task, and projecting its future development is even harder. Thus the following description of the industry's structure must be seen as a hypothesis — well-informed, given the information available, but still somewhat speculative.

Industry Organization

The interactive videodisc design and production industry currently consists of five general types of organizations. The first type is a full service interactive disc production company which specializes in providing state-of-the-art conceptualization, application, design, and production skills. Such companies tend to serve larger corporations which are less cost sensitive. Firms falling into this category include Wicat, ISO Corporation, and The New England Technology Group. Typically, such organizations have, either on staff or available as contract consultants, instructional designers who are experienced in interactive media design and development, specialists in interactive videodisc technology, and writer/producers and directors experienced in high quality video production. These full-service firms have often been built around the continuing efforts of one or two individuals active in the initial design and development of interactive media. They typically have produced a dozen or more interactive discs for two or more clients.

A second type of firm active in interactive disc evolved from the commercial production, design, or display industries. Such firms have taken advantage of their skills and marketing relationships to expand into a new technology with additional benefits for their established customers. Two firms in this category are Sandy Corporation and Maritz Communications, both of which provided corporate communications services to the automobile industry prior to branching out into interactive videodisc production. Others include Ramirez and Woods, which produced the interactive discs used at the Knoxville World's Fair, and the Glyn Group, which has produced videodiscs for Xerox and others, and whose primary business has been in the commercial and corporate film and videotape business.

A third category of producer is composed of the various public broadcast system stations which have been active in developing interactive videodiscs as a source of revenue or as a method of gaining increased skills in this developing medium. Several of the better known production-oriented public stations have made videodiscs, e.g., WNET in New York and WGBH in Boston. The Nebraska Center for Educational Television has been among the leaders in the development of interactive videodiscs.

A fourth category includes those manufacturing companies which have drawn upon their in-house production and design capabilities to develop interactive discs. In general, these organizations fall into two groups. The first is composed of companies such as Hughes Aerospace and McDonnell-Douglas, both of which have been among the prime movers in the development of videodisc technology. These companies have developed interactive discs to meet complex and very specific functions closely related to their business. Other organizations — for example, the University of Washington's Medical School — have explored the use of videodisc as a training mechanism, using their in-house production facilities and their in-house academic staff to design and develop videodiscs.

The fifth category, which is more difficult to identify, includes individuals or very small firms which have been active in selling the concept of videodisc — frequently making contributions to the overall development of disc technology — and have produced discs for one or more clients as a result of their expertise and salesmanship. Typically, these smaller firms do not have in-house production facilities and have relied on outside firms as a source for video production and post-production.

Interactive Videodisc Industry Revenues

Based on reported interactive disc development and production activity during 1983, BCG estimates that approximately $60 million will be spent this year on conceptualization, design, video production, and premastering. This does not include mastering and replication expenses. The vast majority of expenditures were for discs used in training, and over half of the development, production, and premastering activity occurred at videodisc specialists or within the client company itself.

Interactive Videodisc Software Production

Producer	1983 Expenditures					
	Training	Marketing & Merchandising	Education	Entertainment	Publishing	Total
Videodisc spec	13,000	4,000	2,000	500	500	20,000
Production house	10,000	4,000		500	300	14,800
Public Television	500		500		100	1,100
In-house	17,000	2,500	1,000	3,000		23,500
Other	2,000					2,000
Total	42,500	10,500	3,500	4,000	900	61,400

Source: BCG

It should be noted that expenditures noted above for the training and entertainment categories reflect actual disc production costs, and do not include disc research and development activities. Estimates of expenditures for R&D on disc potential for arcade and home videogames alone range from $20 to $75 million for 1983.

Precise allocation of disc expenditures to the three general categories of design and production activity is difficult, due to differing terminology used by various participants and a lack of uniform budgets and organizational structures. However, a comparison of expenditures for several different disc projects suggests that about half of all funds are spent on video production, with the remainder divided between design and premastering in a 2-to-3 ratio. The allocation of expenses varies with the complexity of the disc — highly interactive discs, for example, require a longer and more sophisticated design process.

Estimated Expenditures on Videodisc Production Tasks

Task	1983 Expenditures					
	Training	Marketing & Merchandising	Education	Entertainment	Publishing	Total
Conceptualization & design	12,700	2,600	900	1,000	200	17,400
Video production	21,300	5,300	1,600	2,000	500	30,700
Premastering	8,500	2,600	1,000	1,000	200	13,300
Total	42,500	10,500	3,500	4,000	900	61,400

Source: BCG

Growth projections for each of these industry segments were discussed in earlier chapters.

Patterns of Business Development

When the videodisc design/production business done to date is examined, four distinct patterns emerge in terms of the way the decision to use interactive disc was made and the way in which that decision was carried through.

Pattern 1. The first pattern begins with a company searching for a solution to a specific problem — an increased training load, for example — and, having explored the use of a number of media to meet the problem, determining that interactive disc offers the best solution. General Motors' decision to use disc-based point-of-sale promotion in their dealerships followed this pattern. Once the problem — the lack of an adequate POS device in showrooms — was identified, GM examined the full gamut of promotional media before they decided to use videodisc. Because the decision involved a major dollar investment and a major change affecting the chain of product distribution, the decision was made in the higher executive levels of the corporation, a scenario typical in this first business pattern.

When the decision is made in this way, and when it involves many or all the departments in an organization, the company typically looks to its current supplier of audiovisual materials. GM, for instance, called on Sandy Corporation, with which it had a long-standing relationship. The process of evaluating various media in making the initial decision educates the managers involved, and they then tend to desire a more active role in the actual production of the disc. Because of their involvement, and because the disc is intended to meet a well-defined task, discs produced in this business pattern tend to utilize more of the interactive capability of videodisc.

Pattern 2. A second pattern of business emerging in the interactive videodisc industry begins when a disc designer/producer — typically an entrepreneur — attempts to sell a company an interactive videodisc concept designed to meet some need he has identified from the outside. Instances of this approach actually succeeding are quite rare; however, both the hotel convention center catalog and the stock photo catalog discussed in Chapter 6 represent this business pattern. When the business takes this path, the decision to use videodisc is typically made at a lower corporate echelon than in Pattern 1. The fact that the concept is imported from outside the client organization typically means that the client is less involved in the design and production process. A disc of lower interactivity usually results.

Pattern 3. The third pattern involves a company pushed into the decision to use interactive videodisc in order to stay abreast of the competition. The American Motors Corporation decision to use videodisc point-of-sale promotion is the classic example of this pattern. In this case there is less involvement on the part of the client organization, because the template for the disc's function and design has already been established by its competitors. Most of the decisions demanded of management in Pattern 1 have been taken out of management's hands in this pattern. The decision is typically made and implemented at a lower corporate echelon.

Pattern 4. A final pattern of business that emerges from the current state of the interactive disc industry is the purely speculative and experimental approach taken by, for instance, the publishers who have worked with videodisc or Sears in its videodisc catalog test. Such projects are often initiated outside the main operating structure of organizations, unlike Patterns 1, 2, and 3. Particularly in the case of publishers, they may be defensive moves designed to build some familiarity with a medium that has potential in the future. These projects often operate with more limited budgets than those in the other three categories. However, because one of the intentions is to give people within the client organization some experience with the medium, client involvement may be high.

These four patterns of business influence in different ways the criteria client organizations use in selecting interactive videodisc designers and producers. In most videodisc projects to date, the cost of design and production services has been a relatively minor issue. It is, however, more of an issue in Patterns 2 and 4 than when the company has either turned to videodisc after an extensive comparison of alternative media or been forced to use videodisc to remain competitive. Experience appears to be a much more important criterion than price. Experience in videodisc design and premastering and experience in video production are both important. But because the former is hard to come by, buyers often settle for production experience.

The one criterion which has emerged as most important in videodisc projects to date is the quality of ongoing client-vendor relationships. Ford, General Motors, and AMC all referred their videodisc projects to their established audiovisual providers — despite the fact that these vendors had little, if any, prior experience with interactive videodisc. In effect, the client corporations paid their vendors to learn about interactive videodisc design and production processes — an expensive alternative and one which produced less than full exploitaton of the capabilities of the technology. But by taking this approach, the client derives the benefits of working with an organization its employees and managers know well. Moreover, the fact that the vendor is used for other video productions may mean that it has material on hand which can be used in the disc project, cutting production costs.

Geographic proximity appears to play some role in selecting vendors of interactive videodisc services; clients, particularly those who want to be closely involved in the design and production processes, prefer to work with vendors located near them.

In some cases — notably in Pattern 4, speculative projects producing experimental discs — none of these factors may be very important. Often the client has no established vendor of audiovisual services. In such cases salesmanship, the vendor's track record, and similar issues may be more important.

The companies commissioning videodiscs have shown a strong tendency to resort to full-service vendors or general contractors. Generally the entire videodisc project is off-loaded onto a single entity (which occasionally may be an in-house media services department). This is the case even when clients desire to be closely involved in every step of the production process. In line with this is the general desire of client organizations to work on a firm fixed-price basis. Although contracts for initial discs may incorporate some flexibililty, clients expect the price to be fixed by the second or third disc.

A major complaint voiced by client organizations, and a complaint that may severely inhibit the development of a number of applications of interactive videodisc, is that disc turnaround times are far longer than expected — and far too long by any standard. Ford, in fact, has expressed some feeling that its decision to use videodisc was a mistake, because turnaround times are too long in relation to the timing of new model introductions. This difficulty involves every stage in the videodisc design and production process; the outlook for its resolution is discussed below.

The Design, Production, and Premastering Process

While a great deal of diversity characterizes the ways in which interactive videodiscs are designed and produced, certain basic tasks must be completed in every case. This section examines these tasks, and a variety of the approaches taken to completing them.

Conceptualization of the interactive disc is the first step common to all productions. At its simplest, this could be the decision to transfer existing linear video programs to a disc format, including an index, chapter stops, and one or more quizzes on the material presented. The entire conceptualization of such a disc might take no more than one person's afternoon. At the opposite end of the spectrum, a disc designed to introduce an untrained recruit to the operation of a new and complex weapons system, could require several months of careful analysis of the system's operating procedures, the teaching task, and the appropriate progressions and emphasis. Conceptualization, in this case, could take a training team several months.

The design of the disc grows directly out of its conceptualization, and the line between the two can blur when experienced disc designers are involved. In formal terms, disc design involves the development of a timed flow chart which describes all of the video, audio, and alpha numeric material which will appear on the disc (and accompanying media) and all of the various paths which the end user might take in using the disc. Again, disc design can range from the very simple to the very complex, and standardized formats which have been evolved are continually expanded to accommodate more complex designs. Increasingly, computer-based authoring programs are being used to assist in transforming a disc concept into an interactive disc design. The design process is crucial for several reasons. First, it will directly determine the utility of the disc; a design that does not work will produce a disc that does not work. Second, given the limited capacity of a CAV disc, and the many tasks which discs often address, the value of economy is considerable, and economy is often a function of design. Disc design also determines search time, and an efficiently designed disc can be far less tedious than one with extended search times. Finally, the video shooting script and premastering instructions are both derived from the disc design, and errors in either resulting from faulty design can be expensive to correct.

The third principal step is video production. In practice, this step is little different from the production of any videotaped or filmed program. A script is developed and various scenes are shot to conform to the script. The most noticeable differences between disc production and production for tape or film are the many alternate scenes which the former require to accommodate disc branching patterns and the frequent need to frame individual shots to accommodate overlaid graphics and text.

The final major step is premastering — the assembly of video, audio, and digital information into a set of master tapes which will be used to drive the disc master cutting lathe. Premastering video and audio, although exacting, is a relatively straight-forward process conducted on a computerized videotape editor. The interweaving of additional information, including the computer program necessary to run the disc, and computer-generated alpha-numerics and graphics can increase greatly the complexity of the process and the time and expense required.

The Economics of Design, Production, and Premastering

Several variables influence the cost of disc design, production, and premastering. The first is the complexity of the task being addressed. If the task is a difficult and intricate one, such as the weapons system training example mentioned earlier, the conceptualization and design processes can be protracted affairs, and the video production and premastering phases may be marginally longer. If the task is a simple one, conceptualization and design can be quickly dispatched.

The second principal variable influencing costs can be loosely defined under the term "production values." If the video portion of the disc requires an exacting, quality look, similar to that of a theatrical motion picture or a television commercial, the costs of production will rise dramatically. Similarly, if the cost of a star's salary or extensive travel for on-location production must be added to the budget, overall costs will be driven up. Conversely, if the appearance of the video is relatively insignificant to the disc's utility, or if the video can be presourced elsewhere (i.e., from existing tape, film or slides), video production costs will be minimal.

The third variable effecting disc cost is the level of interactivity of the disc. A near-linear disc, with limited branching and alpha-numerics, requires less design work and can be quickly premastered. A level 3, 4, or 5 disc, which may address relatively simple tasks but in a highly interactive manner, calls for extensive and careful design, large amounts of on-disc and off-disc software, and a major commitment to premastering.

The actual cost structure also depends on who does the work and where it is done. Some tasks can and should involve client personnel — particularly conceptualization and design — and their costs are frequently not included in disc budgets. Also, it is axiomatic that video production and editing costs fall as the work location is moved away from New York City or Los Angeles. Thus, for example, premastering activities may cost $300 to $400 per hour in a top-flight commercial video post-production facility in New York and $100-$200 per hour at a mid-western public television station.

The range of principal costs, then, can vary widely. The following chart provides cost estimates for "average" Level 1 and Level 4 discs designed, produced, and premastered at an "average" facility.

Videodisc Cost Structure

	Task			
	Conceptualization	Design	Video Production	Premastering
Simple Disc Level 1	$2,000	$2,000	$30,000	$5,000
Complex Disc Level 4	$100,000	$50,000	$600,000	$150,000

Source: BCG

Because of the great variety of types of discs which will be used by each market segment, it is misleading to suggest average investments in conceptualization, design, production, or premastering for an average disc for any one segment. It can be useful, however, to examine the range of expenditures for discs currently being produced for various segments and the typical allocation patterns for these costs across the principal disc production tasks.

Videodisc Cost Distribution

Segment	Task				
	Total Costs ($000)	Conceptualization	Design	Video Production	Premastering
Training	$40-$400	15%	15%	50%	20%
Marketing	$60-$400	10%	15%	50%	25%
Education	$30-$200	15%	10%	45%	30%
Entertainment	$50-$1,000	15%	10%	50%	25%
Publishing	$40-$200	15%	10%	55%	20%

Source: BCG

Obviously, each category allows for considerable variation.

B. THE NEXT GENERATION OF THE VIDEODISC INDUSTRY

While the videodisc industry of the late 1980s will evolve in large part directly out of the collection of organizations now providing interactive disc services, a variety of other external factors and trends will combine to shape the industry.

These factors and trends include:

- The development of disc premastering, mastering, and manufacturing technology and the effect of this development on capital equipment investments necessary to complete these tasks.
- The development of computer-assisted videodisc authoring and design systems.
- The growth of a cadre of trained and experienced interactive disc designers and producers.
- The volume of interactive discs commissioned by end-users and distributors.
- The increasing installed-base of interactive disc players in business, institutional, and residential settings.
- The availability of financing to meet capital investment and working capital needs.
- The availability and cost-effectiveness of competing media.

The following pages examine the likely occurrences in each of these areas and the implications they will have for the development of an interactive videodisc industry.

Premastering, Mastering, and Manufacturing Costs

The majority of premastering facilities currently used by interactive videodisc producers are actually television post-production facilities. These facilities, which exist in virtually every television station in the country and in many stand-alone production and post-production companies, contain most of the equipment needed to premastering interactive videodisc. A full premastering facility, which can accept all types of video inputs and generate low-level computer animation and alpha-numerics, currently costs in the neighborhood of $500,000 excluding a building. The equipment typically found in such a facility would include 2-inch, 1-inch, and 3/4-inch videotape machines; a character generator; an effects generator and video switcher; a computerized editor; film and slide chains; and a complete audio post-production set up.

Equipment of particular importance to interactive videodisc premastering are a computerized editor and a videodisc simulator. Although broadcast television editing can often be done manually because editing tolerances need not be exceedingly tight, most production centers have computerized editing machines capable of driving 2-inch and 1-inch format videotape players. The closer tolerances needed for interactive videodisc premastering require a computerized editor of greater exactitude than those used in many television post-production facilities.

A videodisc simulator provides a simulation of the finished videodisc, utilizing the assembled videotapes and any computer-based data, prior to the investment in mastering and stamping the disc. In essence, a simulator provides insurance that the disc will "work" before $10,000 and several weeks have been invested in preparing a proof disc. A computerized editor of the type necessary for frame-by-frame editing in the premastering process costs approximately $30,000. Disc simulators are available at about the same price, although a simulator fast enough to approximate the user's experience with an actual manufactured disc costs closer to $100,000.

A limited input studio without 2-inch videotape players and with a less complex effects generator and switcher can be assembled for approximately $200,000. Post-production equipment costs have been downtrending for the past 20 years as a result of the spread of videotape equipment, the entry of a variety of new manufacturers, and the introduction of new technology, for example, 1-inch and 3/4-inch videotape. While some continuation of this trend can be expected, it is unlikely that the investment necessary to assemble either a limited or full capability post-production facility will drop dramatically over the next five to ten years. The cost of computerized editors, however, can be expected to drop gradually, and the need for a videodisc simulator is likely to decrease. There are two reasons for this. First, as greater experience is gained in the design and architecture of interactive videodiscs, the need for the end user to see "how the disc will play" will drop. In effect, end users will become more confident that the disc will play as designed. Secondly, the cost in dollars and time of mastering and manufacturing a proof disc may drop dramatically.

Laser disc mastering equipment currently costs approximately $300,000. Mastering equipment for CED disc is available for about half that price. Basic disc pressing equipment for either technology costs approximately $1 million dollars. Given the high cost of maintaining mastering and pressing facilities and the limited number of discs currently being pressed, there are understandably few disc mastering and production facilities available (4 for the laser disc and 2 for the CED format).

However, several companies, including Quixote Corporation and Videodisc Technology, are developing low-cost mastering and pressing facilities for the laser disc. They expect to have $50,000 tabletop machines for mastering and pressing laser discs ready for market within two years. If these machines come on the market, and many observers expect that they will, it will be possible to master and press a proof disc at far lower cost. Videodisc simulators will then be unnecessary for most premastering studios.

These potential and expected developments suggest several things about the facilities side of the videodisc premastering, mastering, and manufacturing business of the future. First, increasing numbers of television post-production studios will begin to handle videodisc premastering, particularly as they upgrade their computerized editing equipment. Second, corporate video production departments, currently used primarily for videotape and closed-circuit television production and teleconferencing, will make the incremental investment necessary to handle some interactive disc premastering functions.

Development of Computer Assisted Disc Authoring and Design

A number of organizations are currently marketing or designing computer assisted videodisc authoring systems. Such systems resemble the computer assisted systems developed in the early '70s to facilitate the design of programmed instruction. In essence, such systems translate the overall content and objectives of a task into a discrete series of steps which can be scripted for videodisc.

There is currently little consistency in the videodisc design process across the industry. One major videodisc producer described the typical design and authoring process for a training disc as "a couple of bright guys in a room with a training director for two days." Such an approach, while it may make sense at present, is unlikely to exploit the full capacity of interactive disc, and unlikely to create momentum in interactive disc usage among users with complex tasks. The need for systematic and consistent authoring approaches will result in the commercial availability of authoring software within the next 18 months to 3 years. Such software is likely to focus on specific types of tasks, such as early childhood education. As the software becomes available, the interactive disc will become increasingly accessible to larger numbers of potential users.

Interactive Disc Designers and Producers

The current generation of interactive videodisc designers and producers come to the industry from a wide variety of educational and career backgrounds, and their primary orientations toward videodisc reflect their backgrounds. They can be divided into four general catagories:

Content-oriented producers generally come from within a client organization — e.g., an automobile manufacturer — and become involved in videodisc production in the context of procuring a disc for a specific task — e.g., training auto mechanics. The background of these producers is typically in training, marketing, media services, or management. Their primary objective is accomplishing the prescribed task, not exploiting fully the interactive capability of videodisc technology.

Technology-oriented producers come from a background in engineering and the development of interactive videodisc hardware and software. They are generally very aware of the technical capabilities of videodisc and exploit them fully in the discs they produce.

The third group, composed of production-oriented personnel, who are typically traditional motion picture and video tape producers and directors, has a long history in video production but limited experience in interactive disc development and design. Frequently, individuals in this group are most talented at pulling together all of the many varied elements which must go into an interactive videodisc and managing the process of disc design, video production, premastering, etc. In many respects, these individuals might be seen as professional production managers.

The fourth group, composed of user-oriented personnel, comes out of the training industry and the human factors disciplines and to a lesser degree the graphic design industry. Individuals in this group tend to focus on the interaction between the end user of the disc and the disc itself, and their objective is to insure that that interaction is both productive and directed toward achieving the original objective of the disc.

Few of the interactive disc producers and designers who have emerged from any of these backgrounds began their careers with the intention of participating in the videodisc industry; up to this point the staffing of the industry has been "catch as catch can." However, this is likely to change over the next few years as the tasks involved in interactive disc production become more routinized, as the industry matures, and as career paths develop.

A major impetus for the standardization of industry staffing will come from the graduates of the videodisc research programs currently functioning in American universities. Schools with active videodisc programs include:

- New York University
- San Francisco State University
- University of Nebraska
- University of Colorado
- University of Iowa (at the Computing Center)
- Massachusetts Institute of Technology
- UCLA — Annenburg School of Communications
- Utah State University

Two developments can be expected. Downstream tasks in videodisc production — video production for disc and premastering — will become routinized. They will be the province of videodisc production engineers who resemble the highly skilled younger generation of public broadcasting engineers. Upstream tasks — conceptualization and design — will receive more emphasis and will be the province of graduates of university videodisc programs. These graduates will have a sophisticated understanding of interactive video as well as finely-honed skills in adapting the technology to various types of tasks. As these developments take place, the utilization of interactive video will become more effective and costs will come down.

The Volume of Commissioned Interactive Videodiscs

Interactive videodisc is already being used in a variety of industries to perform a highly differentiated set of tasks, as indicated by the case studies and examples of disc applications throughout Chapters 2-6. This bodes well for the continued development of the videodisc industry. The industry will tend to organize itself around the applications emerging early in its development, and the fact that the current market is highly differentiated will ensure that interactive videodisc develops in a way appropriate to meeting the demands of a broad market.

Learning curve effects are likely to vary depending on the function examined. In those functions generic to all types of discs, for example, premastering and manufacturing, production has doubled quickly and costs have fallen steadily. In the more individualized functions, such as conceptualization of training discs or the design of point-of-sale discs, experience is building more slowly. However, because so few discs of any type have been produced by single organizations, costs in these functions are also likely to drop.

The Increasing Installed Base

Interactive videodisc is a medium which requires special hardware — the videodisc player. This makes a company's first use of interactive videodisc relatively expensive. However, once the player is installed, it can be used to access programs directed to tasks other than the initial project for which the hardware was purchased. Thus, every innovative videodisc program produces a new layer of videodisc players. Moreover, as noted in earlier chapters, the use of interactive videodisc tends to develop on an industry-by-industry basis. Once industry leaders adopt videodisc for a given purpose, others in the industry are quick to follow, either because of competitive pressures or because the viability of the medium is demonstrated and the risk of adopting it is reduced.

As a result, the installed base of interactive videodisc players in industry can be expected to grow exponentially over the next several years. Sales of non-interactive players, on the other hand, will grow at a rather slow linear rate prior to the introduction of videodisc-based home video games.

As the installed base of industrial players grows, the risk of entrepreneurial investment in generic or non-commissioned videodiscs will lessen. Assuming a present installed base of 100,000 industrial laser-videodisc players, the producer of a $120,000 generic videodisc priced at $300 would need to sell 0.4% of the installed base just to reach breakeven. The current distribution of videodisc players in industry — the fact, for instance, that perhaps 20% of the current installed base is held by the automotive industry and that a large number of machines are dedicated to POS and marketing functions — makes attaining this level of market penetration difficult.

Financing to Meet the Industry's Capital Needs

As interactive videodisc gains greater publicity and use, locating financing to meet capital needs should present little problem. Capital for plant and equipment needs can be generated by equity offerings or through collateralized debt or lease arrangements. Innovative technology-based and communications industries are currently very popular with the investment community. A similar industry, computer animation, has generated several public offerings over the past 8-9 years, all of which were fully subscribed. Working capital for video production houses is typically financed out of internal cash flow or through pre-payment on projects. Working capital needs of the interactive videodisc industry can be met in the same manner.

Competing Media

Very few media offer the unique capabilities of videodisc: high-quality video, stereo sound (or two audio tracks), large storage capacity, quick random access, still-frame capability, and sophisticated interactive potential. As a result, interactive videodisc should find little trouble meeting the competition in applications which depend upon and fully utilize the medium's capabilities. Interactive cable, videocassettes, and computer-aided instruction represent the most important competitors, but videodisc has significant advantages over each. The bandwidth necessary for sophisticated branching in interactive cable is not available on most current cable systems. Videocassette can be expected to compete strongly with videodisc in near-linear applications where production volumes are low and interactivity can be sacrificed to gain faster turn around — e.g., in business communications and new product marketing. Computer-aided instruction offers the greatest parallel to interactive videodisc — at least in training applications. However, videogame manufacturers have apparently pushed computer graphics capability to the limits of present technology and are now investigating the use of videodisc. In any application where realistic images are important to the task being performed, it is unlikely that CAI can compete with interactive videodisc.

C. CHANGING PRODUCTION ECONOMICS

The changes noted above, and others which are likely to arise in the industry will affect its future economics. In general, the focus will move more toward conceptualization and design and away from technology. There are several reasons for this. The availabilty of simulators and computerized editors, along with the development of a far more experienced technical staff, will make the physical production and premastering processes routine and less risky. User firms which don't develop these capacities in house will utilize full service production facilities, which provide complete video production and premastering services to companies whose primary focus is on videodisc marketing and design. At the same time, lower proof or answer disc costs and quicker turn around are likely to diminish the cost of mistakes in the production process. A model of this process can be found in the computerized animation business, where several companies are now producing an intergrated computerized animation machine which requires relatively few technical skills on the part of the user.

As the focus of videodisc production moves toward conceptualization and design, the artist/designer will become more important. Again, models for this approach are seen throughout the media industry. In the motion picture business the camera operator gave way to the cinematographer, who did not operate the camera at all, but rather managed its operation, designing shots and applying his artistic and technical skills. In the computer animation field, the computer programmer is giving way to the artist/designer, who uses the existing technology but is more concerned with results than process.

The evolution of technology and change of focus will result in a redistribution of disc cost. First, the cost of premastering, as a percentage of total costs, is likely to fall, as specialized facilities are developed, computer driven equipment becomes common, and the process is made routine. Currently, premastering accounts for 20-30% of the cost of an average disc. In the future, it is likely to account for as little as 15% — a figure more in line with typical film and videotape post-production costs.

However, video production costs are unlikely to fall dramatically. The video production industry is a mature industry, and cost reductions resulting from systemization and lower priced equipment have been affected by the higher costs of labor. The greatest opportunity for economizing here is in the movement of production away from urban centers and out of unionized facilities. Because the potential for such actions is limited, BCG projects that video production will continue to account for half of total disc cost.

Disc design will benefit from two factors, the expected experience curve effects and the further development of computer-assisted design systems. The benefits realizable from both factors are among the earliest which will influence the cost structure of disc, and design costs are likely to drop to 5-10% of over-all costs.

Conceptualization will draw increased attention in every segement of the disc market as clients focus on applying the capabilities of interactive disc to a widening range of tasks. This new attention, combined with the labor-intensive nature of the task, suggests that one-quarter to one-third of total disc costs are likely to occur in the conceptualization and predesign phase.

CHAPTER 8

STRATEGIC OPPORTUNITIES

The foregoing chapters have presented information about current applications of interactive videodisc and the structure of the disc industry. This chapter uses the preceding information about customer demand and industry supply to identify business opportunities in the emerging field of interactive videodisc. New areas of opportunity most appropriate to the mission, skills, and resources of public broadcasting are highlighted and summarized in the last section, which also includes a discussion of PTV resources and the requirements necessary to take advantage of market opportunities. Public broadcasting's potential roles as a vendor of videodisc production services and a provider of videodisc programming are considered. A general discussion of the factors considered in identifying business opportunities follows, preceding the more specific discussion.

A. FACTORS USED TO IDENTIFY OPPORTUNITIES

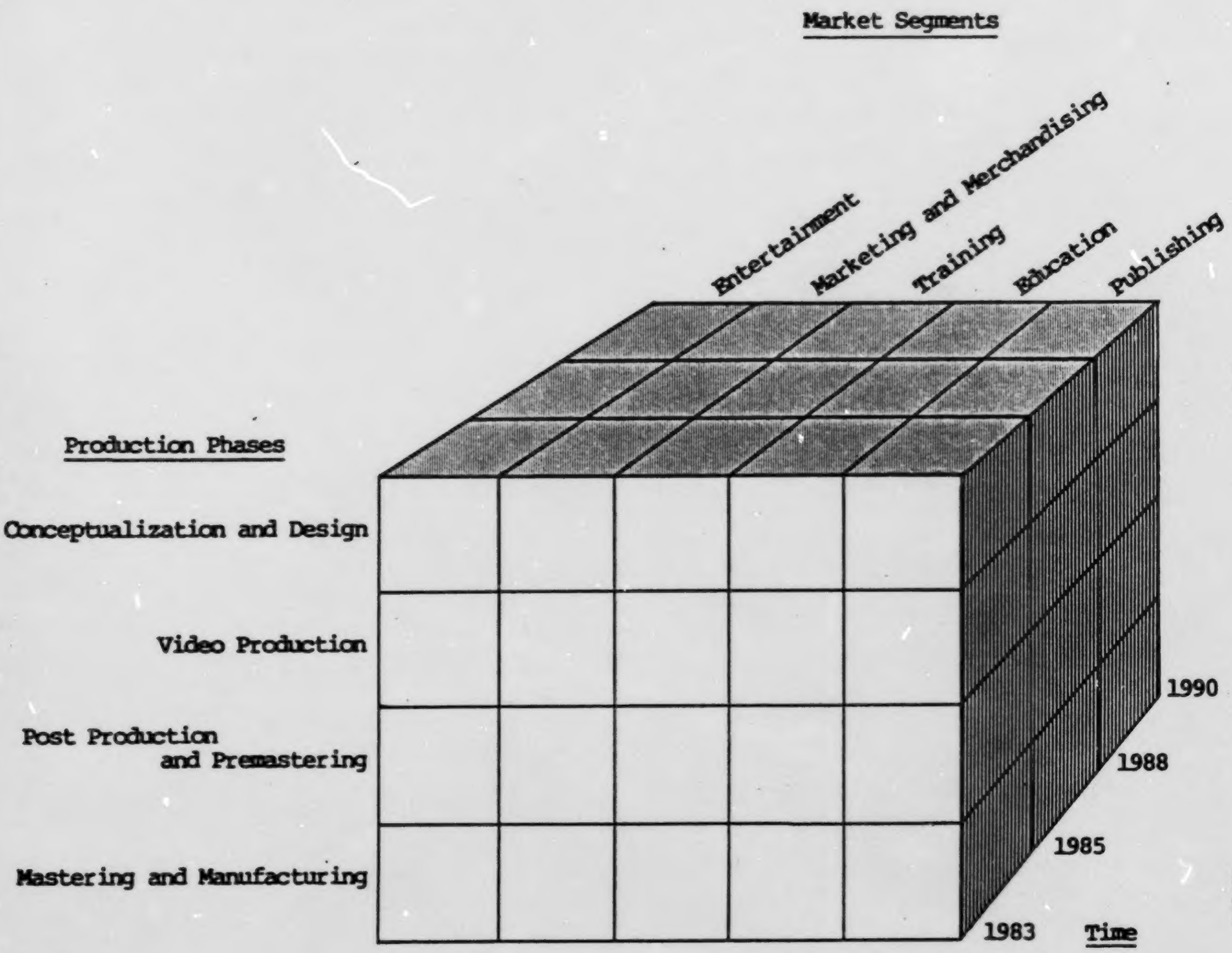
The structure of BCG's analysis of the videodisc industry can be visualized as the three dimensional matrix shown in Figure 1. The five market segments treated in Chapters 2-7 — training, marketing and merchandising, education, entertainment, and publishing — define the columns of the matrix. The four stages of disc production — conceptualization and design, video production, post-production and premastering, and mastering and manufacturing — define the rows. The third dimension, which is critical to analysis of an industry in the developmental stages of its product life cycle, is time. Timing is crucial. A sound business opportunity requires that all essential conditions are favorable at the same time.

The analysis of business conditions at the intersection of the three dimensions (i.e., market segment, stage of production, and time) is based on factors identified in previous chapters which underlie opportunities. These include:

- Hardware in place — Is the installed base of players sufficient to support increased production of programming?
- Recognized need/application — Do prospective consumers recognize the interactive videodisc as a technology that meets their needs? Or, can demand be created through education or advertising?
- Satisfactory quality — Is the product of sufficiently high quality that it is competitive with other media?
- Acceptable prices — Is the market price competitive with other media?
- Technical feasibility — Is this stage of production technically feasible for a particular market segment, i.e., is the state of the art sufficiently advanced?

Figure 1

The Interactive Videodisc Industry


Market Segments
Entertainment
Marketing and Merchandising
Training
Education
Publishing
Production Phases
Conceptualization and Design
Video Production
Post Production and Premastering
Mastering and Manufacturing
1990
1988
1985
1983
Time

- Resource availability — Are the required physical and human resources, including production facilities, equipment, and skills, available to meet the needs of each stage/segment?

- Economic feasibility — Is interactive videodisc production economically feasible for the market segment, given capital requirements and market conditions?

- Entry barriers — Are there barriers to entry in the production phases or market segments? Barriers identified include the market power of existing suppliers, vertical integration, geographic distance, access to marketing channels, etc.

For the following analysis of strategic opportunities, BCG has considered all these factors for each market segment, by production stage, and across time. Conclusions about opportunities for PTV reflect positive market factors and the absence of insurmountable barriers to entry.

B. MARKETS WITH LIMITED OPPORTUNITIES FOR PTV

The Entertainment Industry

The entertainment market is currently the largest market for videodiscs, but it is dominated by linear feature-film videodiscs and the Hollywood studios which produce them. The production of linear entertainment videodiscs involves simply transferring motion pictures from film to a videotape master and then to videodisc, a process carried out in dedicated facilities owned or leased by motion picture studios or disc manufacturers. Vertical integration here leaves little room for public broadcasting's presence as a provider of production services.

The other role public broadcasting might play in the linear entertainment disc industry is, of course, that of a program producer. Existing music or entertainment programs produced by public broadcasters could be transferred to linear discs and marketed to the public through retail outlets, mail order, or the PTV stations themselves. Public broadcasting may ultimately find itself in a position to enter the market in this way. It is a long-term prospect, however, since the installed base of videodisc players is not large enough to support the marketing of discs to the relatively narrow audience PTV attracts. Videodisc versions of PTV programming will generally appeal to a far smaller proportion of the total market than feature films, and will thus demand a much larger installed base than will be available in the near future. Moreover, before the installed base of consumer players reaches a level that would offer public broadcasting a reasonable expectation of profit, the market will be changed dramatically by the introduction of interactive disc-based home videogames.

The introduction of home videodisc games is expected two or three years after they reach the arcades, i.e., late 1985 or 1986. Rapid penetration of the consumer market can be expected, as indicated in Chapter 5. This will produce a large base of highly interactive consumer machines, as well as an exponential rise in the sales of videodisc games. However, at least in the early stages of this development, public broadcasting will be limited by its inability to compete for technical design expertise and because of facilities and capital investment constraints.

The design and production of current microprocessor-based home videogame cartridges is a highly technical craft typically performed by specialists using dedicated facilities. The cartridge business also involves a great deal of risk. Like phonograph records, videocassettes, or videodiscs, game cartridges follow a "hit" pattern; a large proportion of the sales of any given cartridge occurs shortly after its introduction, before consumers are attracted to newer cartridges. A January 1983 poll of retailers by Video Marketing Game Letter indicated that the "hit life" of game cartridges was typically 2-4 weeks. Game manufacturers must invest heavily in both promotion — to produce a profitable hit — and mass production capacity — to ensure the ability to meet demand during the hit cycle.

But the investment required to bring microprocessor-based videogames to market pales in comparison with the investment videodisc-based games will demand. Disc game manufacturers will incur all the current costs videogame manufacturers must bear, plus the added costs of video production; disc premastering, mastering, and stamping; and, perhaps, the additional cost of a cadre of highly skilled animators. As the costs of manufacturing rise, so will the risks. Because of the size of the investment and the risk involved, the production of home videodisc games will likely be the province of only the largest videogame manufacturers and motion picture studios. Dedicated production facilities will be the rule; and subcontracting production, other than animation, to outside vendors will be practically non-existent.

It is unlikely, then, that public broadcasting will realize business in providing videodisc production services to the videodisc game industry, given the highly specialized nature of game production. However, the spread of these games will create a large installed base of highly interactive disc players, and this base should ultimately be large enough to warrant the marketing of PTV programming on videodisc.

Bringing PTV material to this market might take three routes. First, public broadcasting programs or their characters might be used as the theme for a disc game, probably with educational intent. But again, because PTV has no expertise in the production of such games, public broadcasting would be more apt to find itself in the position of licensing the use of material, rather than as a producer of games.

A second possibility for PTV involves producing interactive discs in the "how-to" or home education categories. This possibility will be discussed in the succeeding section, under publishing.

The interactive players used for videodisc games will also be able to play linear discs, and thus, as their numbers grow, will ultimately offer an installed base large enough to warrant the marketing of PTV programming in a linear format. This represents a third possibility for PTV in the entertainment market, one that may materialize as early as 1986.

In summary, the entertainment market will not present a likely role for public broadcasting as a vendor of videodisc production services in the short or long term. Sufficient technical expertise in game conceptualization and design is not available, and most production will occur in dedicated facilities. However, the growing installed base of consumer players should by mid-decade offer PTV sufficient incentive to market its own productions in a linear format.

The Publishing Market

Interactive videodisc's current share of the publishing market is negligible, and this market is expected to develop more slowly than any other analyzed in this report. The potential publishing market for interactive videodisc involves two very different applications of the technology: archiving (or publishing of microforms) and a business analogous to book publishing. These applications appeal to distinct customer groups.

Though videodisc represents a particularly good medium for archiving, with its massive storage capacity and quick random access capability, two of the leading vendors of microform archiving media, Kodak and 3M, have cast doubt on the near-term economic viability of most disc-based archiving applications. The stability of the medium over time has not been established. Because of the high cost of short-term archiving and uncertainty about long-term archiving, the market is likely to develop slowly. But even if archiving applications develop rapidly, the production process will involve a largely mechanical transfer of images from some other medium to videodisc. This will probably be carried out in the dedicated facilities of a few companies specializing in disc archiving, since mass production will allow for economies of scale and more competitive pricing.

Some existing public broadcasting facilities may be suited to producing archiving discs; GBH Enterprises is currently marketing a similar mechanical process — transferring material from film to videotape principally for the advertising community. But it will be difficult for PTV to compete with dedicated commercial disc archiving facilities on a cost basis. The establishment of a dedicated PTV disc archiving facility would require a large capital investment and would probably generate some disgruntlement in the private sector. For these reasons, archiving is unlikely to become a significant business for PTV. However, there may be some opportunities in areas where the convenience of PTV stations and their approach to business are well suited to clients' needs and where price competition is less of an issue than high quality production. The archiving of museum collections is one such specialized area.

Involvement in the book publishing side of this market is a more feasible opportunity for public broadcasting, both as a vendor of disc production services and as a publisher. Major U.S. publishers have adopted a "wait-and-see" attitude toward videodisc; few find the present installed base of consumer machines large enough to warrant investment in disc publishing. However, if the introduction of videodisc games produces as large an installed base as is expected, publishers will move to take advantage of the new market. If home disc games are introduced in 1986, by 1988 the number of consumer machines should easily reach a level sufficient to support entry by many publishers. Publishers can be expected to produce a handful of pilot discs (perhaps 5-10 per year) until the installed base reaches an entry-justifying level. Early discs are likely to include interactive cookbooks and "how-to" or self-help books.

Publishers attempting to enter the market are quite likely to use outside vendors to aid in the design and premastering phases of production, as well as in video production, primarily to avoid investment in equipment and facilities. If public broadcasting is positioned to provide these services, videodisc publishing could provide substantial business in the latter part of the decade. The publishing market will not, however, offer PTV the resources necessary to position itself in the short term to take advantage of the market once it develops. Publishing software will not drive the penetration of videodisc hardware, and so will come to market only after the installed base has reached a level that can support entry by publishers. If PTV is to serve this market, it will have to use other segments to fund its positioning in the near-term or engage in experimental joint ventures with publishing houses to ensure its place as a service vendor at the end of the decade.

As noted before, the spread of videodisc games should ultimately produce a base of consumer players large enough to warrant the marketing of non-entertainment public broadcasting productions on videodisc. PTV's reputation and experience in educational and instructional television make this a natural market. But again, this is a long-term opportunity which public broadcasting can take full advantage of only by positioning itself now through participation in more developed segments of the disc industry.

In summary, the publishing market is likely to be the slowest of the interactive videodisc markets to develop. There may be a limited market in archiving, such as in specialized collections. However, it is doubtful that PTV will want to make the investment required to establish a price-competitive dedicated facility needed to serve the broader archiving market.

The publishing market for how-to discs and similar consumer-oriented publications represents a more realistic PTV opportunity. However, the market will not mature until a sufficient number of videodisc players are in consumers' homes — probably not before 1988. Since publishers are likely to use outside service and production vendors, proper positioning of PTV through experimental efforts with publishers is required to establish relationships now that will pay off later.

The Marketing and Merchandising Market

Significant consumer use of interactive videodisc for home entertainment is two to three years away, and the publishing market will develop even later. By contrast, the use of interactive disc in marketing and merchandising applications is growing rapidly, and represents one of two viable near-term markets (the other is training). The use of discs for marketing involves three types of applications: point-of-sale promotion, cataloging, and sales support.

Although point-of-sale promotion represents a relatively large potential market for videodisc by the end of the decade, it offers little opportunity for public broadcasting as a vendor of videodisc production services. Ironically, the large amount of money involved in this market makes PTV entry less likely. Because manufacturers see point-of-sale promotion as having a high degree of leverage on product sales, their expenditures in this area are quite large. When they move to videodisc-based promotion, they will tend to look to their established vendors for videodisc service. Ford and General Motors, when they made this move, turned to their current vendors, Maritz and Sandy, and ultimately paid these firms to learn about videodisc rather than seek unfamiliar videodisc producers. Videodisc point-of-sale promotion is thus likely to be the province of advertising agencies, established vendors of corporate communications services, and, perhaps, videodisc point-of-sale specialty houses like that recently started by Nolan Bushnell. Public broadcasting can expect little business from this segment of the market.

Some videodisc catalogs, like the American Express travel disc described in Chapter 3, are practically indistinguishable from point-of-sale promotion. The same caveats mentioned above apply to the potential market for PTV services in producing such discs. Such catalogs will largely be the province of Madison Avenue and established commercial production houses.

Less promotion-oriented catalogs may offer more opportunity for public broadcasting. Such catalogs are likely to be even more common in industrial applications, such as the stock photo agency catalog described in Chapter 3, than in consumer applications. Here the promotional function will be less important, since the catalog will serve largely as an efficient screening mechanism. The production process for this application will resemble archiving, i.e., the mechanical transfer of images from another medium to videodisc. As with archiving, public broadcasting could compete in this arena, but doing so will demand establishing a dedicated assembly line and making substantial capital investments.

The third marketing application for interactive videodisc was discussed earlier under the heading "sales support," and involves using a videodisc-based audiovisual presentation as an integral part of a larger sales presentation. Videodiscs are increasingly used in sales, particularly of high-ticket or complex products such as computers, agricultural equipment, etc. This use of videodisc may ultimately become quite standard in industrial sales, because of the advantages videodiscs offer over other media: discs are less likely to be damaged and offer a random access capability that allows salespeople to easily customize presentations. The full exploitation of videodisc as a sales support tool will await development of portable presentation systems combining disc player and television monitor, but many expect such systems within the next two or three years. Following the expected introduction of integrated portable videodisc units in 1986, rapid growth of sales support discs is projected.

Selling high-ticket industrial equipment — the area in which disc is likely to be most used — typically involves education as well as promotion. Buyers want a realistic view of the equipment's capabilities, and an overly promotional tone can be a liability. Because of public broadcasting's reputation for high quality, non-commercial video, it could find a market in this area. However, established relationships between industrial equipment manufacturers and agencies may serve as a barrier to PTV's entry in this market.

Opportunities for PTV in marketing and merchandising are very limited because of the nature of the product, and more importantly, because of pre-existing relationships between firms which want to develop discs and service vendors that can produce them. Unless PTV chooses to establish relationships with industrial equipment manufacturers which produce discs for sales support, it is doubtful that many opportunities exist for public broadcasting in marketing and merchandising.

C. BUSINESS OPPORTUNITIES FOR PTV

The Education Market

Applications of interactive videodisc in the education market fall into two categories: the electronic blackboard and the interactive learning center. The first category is represented by the SPACE DISC discussed in Chapter 4 and the Nebraska Project's tumbling and Spanish discs. An example of the second category is the CPB/Annenberg-funded laboratory discs.

While the interactive videodisc has capabilities that are extraordinarily useful in education and much of the developmental work in the technology has taken place in educational settings, little software has been developed for any of the three major levels of the education market: 1) elementary/secondary, 2) post-secondary, and 3) vocational-technical. Educational institutions have historically been slow to adopt new media. Audio recordings, slides, films, and television were all accepted into classrooms only after they had become relatively commonplace in the household or entertainment marketplace. There is little reason to expect that videodisc will be adopted more quickly. Interactive videodisc laboratories may be common in schools only after the technology has been thoroughly developed for use in home video games, and videocassettes are more apt to be the first-choice replacement for 16mm motion pictures in classrooms.

Recent expressions of public concern about primary and secondary education and the probability that education will be an election issue in 1984 may spawn increased attention to and funding of educational institutions. But most of this attention appears to be directed toward the human component of the education system — teacher quality, salaries, and workload; school day and school year length; student motivation; etc. It is not clear that technology will be considered an appropriate solution to the recently illuminated problems.

These factors indicate slow growth for videodisc in the educational market. However, level 2 videodisc players, which can be used with materials like SPACE DISC to custom tailor classroom presentations, are not exhorbitantly expensive, and should prove attractive to some teachers. Tests of similar educational discs conducted by the Nebraska Videodisc Group and Children's Television Workshop at the elementary and secondary levels elicited enthusiasm from teachers. Thus, the electronic blackboard is likely to grow, if slowly, through the end of the decade.

Highly interactive learning centers, like the one produced in the CPB/Annenberg laboratory disc project, are a great deal more expensive than level 2 systems, since they involve a disc player, computer, and interface. Even if they prove acceptable to the educational community, such learning stations will be available to few schools apart from substantial subsidies from government, foundations, or private industry.

Despite these caveats, interactive videodisc is likely to eventually become a very important educational medium, both as audiovisual aid and as learning center. But its development to this point will take a number of years — probably into the 1990s. The state of the educational market for interactive videodisc as described here places public television in a peculiar position.

Public broadcasting has an enormous fund of goodwill among educators. Its programming is used in a substantial number of U.S. classrooms and as a source of home learning recommended by teachers. Educators who have worked closely with the public broadcasting system represent an unrivaled body of expertise in the design of educational applications of new technologies. Public broadcasters and their program suppliers have greater experience with educational and instructional uses of video than any other group of comparable size. For all these reasons, educational applications represent the most obvious market for both PTV videodisc production services and PTV-produced instructional videodiscs.

Yet, despite the resources, the skills, the contacts, the mission, and the desire to serve the educational market, the development of the market is a somewhat distant prospect. If public broadcasting is to serve this market when it develops, some other current market which utilizes many of the same skills and resources and which is consonant with public broadcasting's mission must serve as the arena in which PTV hones its skills in videodisc production and establishes its presence as a vendor of quality videodisc production services. The market which offers the best fit with these needs is the training market.

The Training Market

Over the next four or five years, the training market will generate the greatest demand for interactive videodiscs and for interactive videodisc design and production services. Because of the fit between the needs of this market and the skills, resources, and mission of public broadcasting, training offers the best near-term opportunity for PTV to establish a presence as a provider of disc services.

Recalling the figures from Chapter 2, BCG projects the production of more than 250 interactive videodisc titles for training applications in 1984 and more than three times that number in 1986. With the exception of entertainment discs (primarily feature films and games), training applications will account for more disc production than any other segment through 1988.

Demand for Videodisc Production in the Training Market

Training Type	Projected Disc Titles Produced			
	1984	1986	1988	1990
Product Service	160	500	1500	3000
Product Marketing	56	250	1800	6000
Equipment Operations	20	50	120	250
Employee Procedures	—	20	100	500
Generic	—	10	50	200

Source: BCG

The training market is made up of a number of segments corresponding to various types of training, and demand for disc production in these segments will develop at different rates. BCG expects interactive videodisc to be accepted by growing numbers of companies as an appropriate medium for product service, product marketing, and equipment operations training in the middle 1980s.

Product service training and product market training are expected to generate the largest demand for videodisc production both in 1984 and through the end of the decade. Of these two, product service training represents the more appropriate market for videodisc services provided by public broadcasting. Product marketing discs will often do double duty, serving to introduce both salespeople and customers to new products. Moreover, some of the footage used in producing such discs may be used in other types of advertising and promotion. With such multiple use in mind, manufacturers will tend to turn to their established vendors of video production services for videodisc production. This will be less the case with product service discs intended solely for internal use. As was mentioned in Chapter 2, Ford Motor Company used its established vendor, Maritz, for the production of its marketing discs, while a number of outside vendors have been used for the mechanic training discs. Product service discs are also likely to require a higher level of interactivity than the relatively straightforward presentation of a new product, and the PTV's considerable understanding of videdisc's interactive capabilities represents a competitive advantage in this area.

This assessment is in no way intended to suggest, however, that public broadcasting should disregard the other segments of the training market. Rather, the point is that product service training represents the largest and one of the most appropriate near-term markets for PTV videodisc production services. Projects in any area of training can only add to public broadcasting's fund of videodisc experience.

The task of training workers, particularly as major shifts in the nation's economic structure necessitate retraining displaced workers, is a task congruent with public broadcasting's educational mission. The need for such retraining is expected to increase steadily through the end of the decade. By gaining additional experience through videodisc training projects undertaken in the near-term on a commercial basis, public broadcasting will put itself in a position to serve with government, industry, and labor to meet the need for retraining as it develops. Federally-sponsored training programs such as the Job Training Partnership Act may represent longer-range opportunities for PTV involvement in development of interactive videodiscs for training.

Public broadcasting's reputation in the field of educational and instructional television, and its close connection with the educational community represent resources particularly appropriate for addressing the needs of the training market.

Summary

Recalling the three dimensional matrix shown in Figure 1, this chapter has focused thus far on the columns, i.e., the rate at which each of the markets for interactive videodisc is developing and the fit of the needs of each market with public broadcasting's mission, skills, and resources. In other words, the extent to which each market represents a potential videodisc business has been measured, and the appropriateness of that market for public broadcasting has been determined.

To recapitulate opportunities discussed in each of the market areas:

Entertainment - A market for linear videodisc versions of PTV programming may develop, but the potential for this business is currently constrained by the small installed base of videodisc players. Entering this market will require home video rights for the productions, a potential legal barrier which must be addressed prior to PTV's entry. The videogames portion of the entertainment market is not a likely business candidate for PTV because of the ever-increasing technical demands of product design, the large capital investment required to bring a game disc to market, and the resulting high risk.

Publishing - Publishing PTV material will also require home video rights. The publishing market will not be large until about 1988 and will generate little demand for videodisc production services before then. However, if PTV can establish experimental projects with publishing houses now, they will be further on the learning curve, have well-established relationships, and be market-ready when the time comes.

Archiving, in special instances (such as museums), may represent an opportunity for PTV; but competing with dedicated archiving facilities would require substantial investments in equipment.

Merchandising and Marketing - Few opportunities exist for PTV in marketing and merchandising, given the in-house capabilities of major advertisers and their established relationships with vendors.

Education - Education is the ideal market for PTV; however, no market exists currently. PTV can either attempt to build the market up or be ready when the market develops through involvement in training now.

Training - PTV has all the resources needed for producing interactive videodiscs for training purposes. What is missing is relationships with possible customers in the public and private sectors. Such relationships can be established relatively easily and immediately.

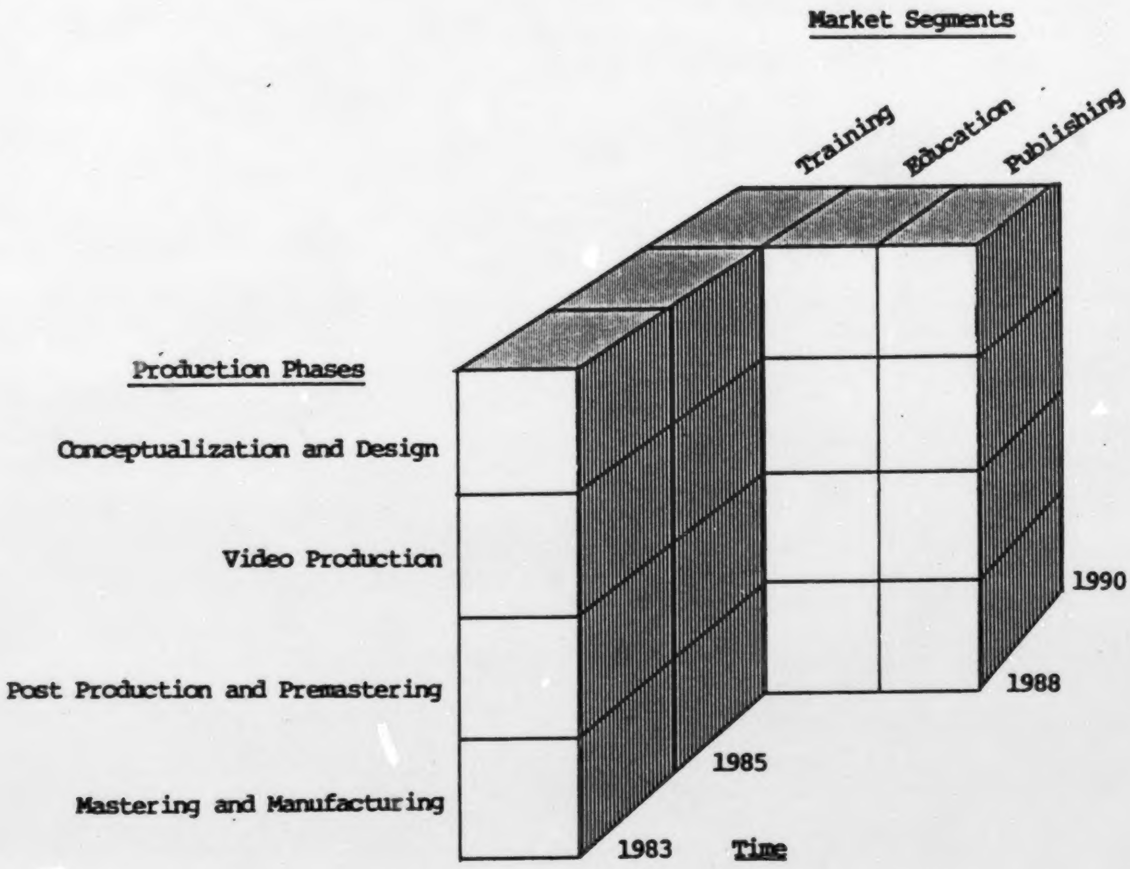
Figure 2 incorporates these findings into a redrawing of the matrix, leaving only those columns which represent an opportunity for public broadcasting as a provider of videodisc production services. The following discussion will examine more closely public broadcasting's ability to exploit those opportunities. Entertainment, education, and publishing all offer some opportunity before the end of the decade for public broadcasting to assume the role of videodisc programming producer. But gauging PTV's ability to take advantage of these opportunities is rather simple, it is almost purely a matter of who holds the home video rights for PTV programming. If it is to function as a producer of videodisc programming, PTV must either hold these rights. or acquire them. This being noted, the rest of the chapter will focus on opportunities for public broadcasting as a provider of videodisc production services.

D. INTERACTIVE VIDEODISC PRODUCTION AND PUBLIC BROADCASTING

Calling those parts of the matrix that are left in Figure 2 "opportunities" for public broadcasting means that the markets represented are expected to develop by the time indicated and that, when broadly considered, the market and its needs correspond well to public broadcasting's mission, skills, and resources. But in order to determine how public broadcasting should respond to these opportunities, the latter point must be examined in greater detail. Producing an interactive videodisc involves four major steps: conceptualization and design, video production, post-production and premastering, and mastering and manufacturing. These are represented by the rows of the matrix in Figure 2.

Figure 2

Interactive Videodisc Market Opportunities for Public Broadcasting


Market Segments
Training
Education
Publishing
Production Phases
Conceptualization and Design
Video Production
Post Production and Premastering
Mastering and Manufacturing
1983
1985
1988
1990
Time

Any one of these stages of production could conceivably form the basis of a business in the interactive videodisc industry, i.e., a company might provide conceptualization and design services for interactive videodisc producers, while involving itself in none of the other stages of production. (Courseware is an example of such a company.) Present disc manufacturers, in fact, are primarily concerned with the last stage of the production process, and derive little business from the other areas. Understanding how public broadcasting can best take advantage of the market opportunities which have been identified requires that public broadcasting's skills and resources be measured against the needs of those markets in each of the stages of videodisc production. The following discussion takes up each stage of disc production and the potential it holds for public broadcasting in each of the market opportunities that remain.

Mastering and Manufacturing

For a number of reasons, involvement by public broadcasting in the last stage of videodisc production, mastering and manufacturing, is inadvisable. The primary reason is cost; establishing a videodisc mastering and manufacturing plant would be extremely expensive. Current public broadcasting system facilities could not serve as the nucleus of a disc replication facility, rather, the entire plant would have to be outfitted from the ground up. A plant capable of producing 10,000 discs per 8-hour shift would need to incorporate the following: a mastering facility complete with computer, digital-to-analog converter, software, a laser recorder, a raw stamper production line (which is a cleanroom facility), a master stamper finishing line, replicating processors (as many as 10), a disc finishing line (cleanroom), and quality control equipment. Ten million dollars represents a conservative estimate of the capital outlay required to build such a plant, not considering the working capital required to staff and operate it.

A capital outlay of this magnitude, while not beyond the reach of public broadcasting, is difficult to justify given the fact that existing disc replication facilities operated by the videodisc player manufacturers and 3M Company are not operating at full capacity. Moreover, because videodisc replication, like most assembly-line processes, involves economies of scale, manufacturers with an established clientele can operate at lower cost than a newly established PTV pressing facility. Competing with the established manufacturers in terms of price (the leverage point open to PTV), would require absorbing large losses until a clientele was established. Nor will an expanding market for videodisc replication render this issue moot; the existing manufacturers will expand to meet the growing demand and still operate more cheaply than PTV. It is doubtful that public broadcasting has either the fiscal resources or the desire to compete in this environment. Nor is such a position clearly congruent with public broadcasting's mission.

Further, an entry into this stage of the videodisc production business will exploit none of the particular skills of the public broadcasting system. Operating a manufacturing plant requires managerial and technical skills quite different from those which develop in the broadcasting environment. PTV would be forced to import talent from the outside, rather than utilizing its existing strengths.

Finally, there would be little strategic advantage for public broadcasting in owning a replication facility. Savings on the mastering and manufacturing costs of PTV-produced discs would be minimal; and the time savings do not represent a significant advantage. The skills acquired in the mastering and manufacturing process bear little relation to the skills necessary to the earlier stages of videodisc production and would thus offer public broadcasting no advantage in pursuing business in those segments.

In sum, then, through at least the end of the decade videodisc mastering and manufacturing does not represent a viable business opportunity for public broadcasting. The costs of manufacturing facilities are expected to fall significantly by the middle of the 1990s, with the introduction of table-top mastering and pressing equipment and the experience gained through years of videodisc production. If at that time public broadcasting is producing a signficant number of videodiscs, investment in this area may be practical. Until then, it is not.

Conceptualization and Design

The first stage of interactive videodisc production is conceptualization and design. This process moves a videodisc from the initial idea to a frame-by-frame paper model of how the disc will function, a model which serves as both the script for video production and the guideline for premastering. As noted in Chapter 7, the complexity of the process varies in direct proportion to the levels of complexity and interactivity of the videodisc proposed. The competencies necessary for participation in this phase of the production process vary according to the intended disc application. While the design of laboratory discs for the educational market demands some competence in the field of educational theory and instructional practice and little knowledge of consumer buying behavior, just the opposite is true for discs intended to serve as point-of-sale promotional devices.

The conceptualization and design of training and educational videodiscs involves three types of competence:

- Type 1 — An understanding of the function of interactive media in general and the capabilities and demands of interactive videodisc in particular.
- Type 2 — An understanding of the learning process and the instructional methods which facilitate various types of learning.
- Type 3 — Expertise in the subject matter to be taught and learned.

The importance of each of these to clients and their availability within PTV and at VDPG are discussed below for each of the market segments.

Competencies in Conceptualization and Design — Training

Training is the largest existing market for interactive videodisc and can be expected to hold that position over the next five years. Moreover, training represents the best near-term market opportunity for public broadcasting as a vendor of interactive videodisc production services.

The table below shows the comparative importance of each of these competencies to buyers of training materials and the availability of these competencies in the public broadcasting system and in the Videodisc Design/Production Group.

Competencies in Training

	Types of Competence Required		
	Type 1	Type 2	Type 3
Importance to Clients	High	Medium	Low
Presence at PTV	Medium	High	Low
Presence at VDPG	High	Medium	Low

At this early point in the development of interactive videodisc training, few prospective clients have much experience with other interactive media — from programmed texts to computer-assisted instruction and interactive videocassette. But many clients are training professionals knowledgeable about learning theory and instructional practice. Because they are located within the company or industry for which the training is intended, their expertise in the subject matter is likely to be high or, in any case, they will assume responsibility for providing that competency to the conceptualization or design process.

Vendor competency in learning theory and educational technique is likely to be less important than videodisc competency, though this will vary depending on the client's own proficiency. Among smaller firms without training professionals or among training managers without formal schooling in educational theory or practice this second competency will be more important. Finally, subject matter expertise will not be expected from interactive videdisc vendors in most cases.

Public broadcasting clearly has the skills and resources necessary to meet these competency requirements. Because of the Nebraska Group's pioneering work in interactive videodisc, its competency in the medium is equalled by few other organizations in the country. Videodisc projects carried out at some of the stations (WGBH has participated in five to date) have given them, too, a fair degree of competence in this area. Taken together, the stations have the ability to draw on a large body of instructional talent from the universities with which they are affiliated. VDPG's involvement in a number of educational disc projects has given it some expertise in this area. In short, with regard to conceptualization and design in the training market, the resources of VDPG and the public stations complement each other.

Competencies in Conceptualization and Design — Education

The educational market for interactive disc is not likely to develop before quite late in the decade, if that soon. However, it represents a natural market for public broadcasting and warrants discussion here.

Training is simply education carried out in a business or industrial context. So the competencies needed for conceptualization and design in the educational market are the same as those in the training market: an understanding of the learning process and educational practice, and subject matter expertise.

Competencies in Education

	Types of Competence		
	Type 1	Type 2	Type 3
Importance to Clients	High	Medium	Low
Presence at PTV	Medium	High	High-Low
Presence at VDPG	High	Medium	Medium-Low

Like trainers, the clients for educational disc production services — primarily educators — will have the least competence in interactive videodisc technology and the greatest competence in subject matter. Few authors of educational discs will lack competence in educational practice, yet many authors may prefer to work with vendors who share their competence in this area.

The competence of both VDPG and the stations in the first two areas remains the same as in the preceding discussion of training. But, in a given case, both may have some expertise in the subject matter of the proposed disc, resident either in the regular staff or in universities with which they are affiliated. This expertise represents a broader competence than is actually necessary for serving the educational market through providing production services; on it rests public broadcasting's ability to serve as a producer of educational programming for videodisc once the market matures.

Competencies in Cataloging, Archiving, and Other Publishing

Videodisc cataloging and archiving, though they belong to different markets, represent similar conceptualization and design tasks. Neither involves a high level of interactivity. For both, the first stage of conceptualization and design involves simply determining what material should appear — a task that invariably belongs to the client. Once this is accomplished, the remaining design question is how to arrange the index that guides users through the material. How that question is answered depends on the answer to three other questions: For what audience is the disc intended?; What type of index works best with the audience?; and, What is the best way of placing the material on the disc, given that sort of index?

Answering the first two questions is clearly the province of the client; and after the client has prepared two or three discs, the third question will also fall into his area of expertise. For this reason, neither archiving nor cataloging is likely to generate sustained demand for conceptualization and design services.

Interactive videodisc publishing, other than archiving, is likely to take one of three forms: "How-to" instructional manuals (including cookbooks), learn-at-home discs, and videodisc "novels" or "adventures" which allow the viewer to make decisions that affect the path and outcome of the plot. The interactivity of videodisc how-to manuals and cookbooks will likely involve little more than indexing and generate no greater demand for conceptualization and design services than cataloging or archiving applications. Videodisc novels and adventures will involve sophisticated branching, but the design of most will be intimately bound to the writing of the tale and will generate little demand for outside services. Learn-at-home or home education discs will require the same competencies in conceptualization and design as discs directed toward educational institutions. Public broadcasting's ability to provide those competencies, as was noted above, will be of competitive value once the market develops.

Other Issues in Conceptualization and Design

The foregoing has found opportunities for public broadcasting in three areas of the videodisc conceptualization and design business: training (excluding product marketing training), education, and the publishing of learn-at-home discs. Only one of these markets — training — is viable in the near-term; the educational and consumer markets for interactive disc will not mature before 1988.

A number of issues apart from the competencies already discussed will affect the success of any venture to provide conceptualization and design services to these markets. They include pricing, turnaround times, the vendor's geographic location, its ability to provide the full range of videodisc services, and its corporate culture and orientation.

The importance of **geography**, the proximity of a conceptualization and design vendor to its clientele, varies with the complexity or level of interactivity of the disc. The more complex the project, the more client involvement it demands. Both training and education require highly interactive discs. Clients (particularly educational institutions) will be reluctant to add extensive travel to the already substantial cost of producing an interactive videodisc. Geography has been relatively unimportant thus far in the industry's development; but as the industry grows and vendors multiply, proximity to clients will become an advantage.

A vendor's ability to provide **full service** — conceptualization and design, video production, and premastering — also becomes more important as the complexity of the proposed disc increases. The conceptualization and design process produces both the script for video production and the guidelines for premastering the disc. The more complex the disc, the more important it will be for the designer to oversee the later steps.

Pricing almost always affects a vendor's ability to compete, but it will be more important in the educational market, once it develops, than in the training market. School budgets typically must meet closer tolerances than those of industry training departments.

Turnaround time, on the other hand, is likely to be less important to educators than to trainers. Alterations in academic curricula are typically planned well in advance of implementation and thus provide longer lead times than most training programs.

Finally, the **culture or orientation** of an organization, though less quantifiable than other elements, plays an important role in establishing working relationships with clients. A client accustomed to the tightly-organized, hierarchical structure characteristic of many American companies, for instance, may find it difficult to work with an organization with the less formal, more diffused structure typical of public broadcasting.

Video Production and Premastering

Although video production and premastering are independent steps in the process of producing a videodisc, the factors which determine the viability of a business providing either service are the same. Those factors include:

- Equipment
- Production standards and experience
- Turnaround time
- Geography
- Pricing
- Linkage to other stages of production (full service)
- Culture and orientation

Equipment

The video production equipment necessary for interactive videodisc production is no different from that used in broadcast television production, and the issues of quality are the same. If high quality video is important in a given videodisc project, then more sophisticated video production equipment will be required. The major public broadcasting producing stations all have production equipment equal to or better than the equipment of commercial broadcast stations and commercial production houses in their markets, and many already compete with these entities for video production business.

Premastering, however, demands an extremely clean and accurate computerized videotape editing facility. Only a few post-production studios in the country are equipped to handle premastering efficiently; the post-production studios of the major public broadcasting stations are among them.

Video production for archiving and cataloging involves primarily a straightforward transfer of material from some other visual medium — paper copy, prints, slides, or film — onto videotape. Although this task can be handled with standard studio equipment, it can be performed more quickly with special equipment that mechanizes much of the process. This reduces costs and permits a lower price for the service. Should public broadcasting decide to serve these markets, investment in this special equipment would be necessary.

Production Standards and Experience

Interactive videodisc production requires no particular standard of video production, but high production values will be important to clients in some markets. High production values will be more important in publishing, because the product is directed to the consumer market, and in cataloging, because catalogs are sales tools, than in other markets.

The Importance of Production Values in Various Markets

More Important			Less Important
Publishing Cataloging	Training	Education	Archiving

Although most archiving will not require high production values, some archiving applications, such as recording museum collections, may demand very high quality production. As broadcast production studios, the facilities of the PTV producing stations should have no difficulty producing video of sufficient quality for any of these markets.

The post-production standards necessary for disc premastering are, by contrast, very high, as the discussion of equipment indicated. However, with minimal modifications to current post-production facilities and practices, the major public broadcasting stations would easily meet these requirements.

Turnaround Time

Slow turnaround time for videodisc production is a significant impediment to the adoption of videodisc for certain applications and, if not resolved, may impede its growth. Ford Motor Company has great difficulty fitting turnaround on their point-of-sale and product marketing training discs into the time frame of new model introductions. These problems have been so severe that Ford has questioned the wisdom of its decision to adopt interactive disc.

Though video production is often the most time-consuming stage of the production process, it is also the least likely to be shortened. Video production is an older process than the other stages of disc production, and most of the time saving possible within it has already been accomplished under the pressure of broadcast schedules. Premastering, however, offers ample room for time reduction.

As interactive videodisc becomes more common and experience is gained across the industry, premastering turnaround will be reduced. But in some markets for production services, speed will continue to be a competitive advantage.

The Importance of Fast Turnaround In Various Markets

More Important				Less Important
Cataloging	Training	Publishing	Archiving	Education

The need for video production and post-production resources generated by public broadcasting involvement in the videodisc industry will have to be met within the context of other commercial and non-commercial uses of public broadcasting facilities. PTV stations which currently market their unused production capacity have been successful in resolving the competing claims of commercial and in-house production. They should be able to add videodisc services to this mix without disruption.

Geography

The importance of the proximity of a video production or premastering vendor to clients increases as the need for client involvement increases. Client involvement is more important when the disc is complex or when it exerts a great deal of leverage over the client's business. Thus geography is more important in the training, educational, and cataloging markets than in publishing or archiving. Individually, public broadcasting facilities are geographically isolated, although some are isolated in large markets. But through concerted efforts, the public broadcasting system could offer clients a geographical flexibility unrivaled by any commercial production house.

Price

Because the videodisc industry is young, competition on the basis of price has not yet arisen. But price is a competitive issue in the present video production industry, and there is little reason to think it will not become an issue in the videodisc production industry.

The Importance of Price in Various Markets

More Important — Less Important

Education
Archiving

Publishing

Training
Cataloging

A public broadcasting venture in video production and premastering would compete more readily on the basis of price in the education, publishing, and training markets. Because the mechanical processes involved in archiving and cataloging offer particularly good opportunities for realizing economies of scale, large facilities dedicated to this type of work will be able to offer lower prices than other vendors. Unless public broadcasting makes the substantial capital investment necessary to establish such a facility, it will find competing in these markets difficult.

Full Service — Linkage to Other Stages of Production

Videodisc clients have thus far shown a preference for full-service videodisc production vendors who can take a project from conceptualization through premastering. This may change as clients gain confidence in their own ability to oversee the progress of a disc through the various phases of production and as price competition becomes more important. However, highly interactive discs by nature require close cooperation among designers, video producers, and premastering technicians. The design process produces both the production script and the guidelines for premastering. The more complex the project, the more benefit is gained from resting all these functions in a single organization. Thus full service capability is more important in training and education than in archiving or cataloging.

The Importance of Full Service in Various Markets

More Important — Less Important

Training
Education

Publishing

Cataloging
Archiving

A number of the major public broadcasting stations could independently offer full service to the videodisc industry, although in most cases their conceptualization and design skills would need to be bolstered. A coalition of stations including the Nebraska Videodisc Design/Production Group could readily provide full service over a wide geographic area.

Culture, Structure, and Orientation

The culture, structure, and orientation of an organization are less tangible than the other factors discussed here, but they are nevertheless important ingredients in the way it does business, who it does business with, and the success it has.

In public broadcasting, authority is diffused across a wide variety of managers and teams devoted to specific tasks, both within the stations and the national organization. Individual and group risk-taking is encouraged, so long as the risks can be shown to be congruent with the goals of the public broadcasting enterprise as a whole. Public broadcasting is oriented heavily towards service, in terms of providing the viewing public with alternatives to the fare available from commercial broadcast outlets and in terms of providing independent program producers with an outlet for work unacceptable to commercial outlets. Moreover, the orientation has been decidedly away from profit-making.

This structure, culture, and orientation is clearly foreign to much, though not all, of American industry and business. It more closely resembles the character of educational institutions and other public sector organizations. The disparity does not mean that public broadcasting facilities cannot serve as vendors in the private sector; the enterprise divisions of various stations have proven that this can be carried off successfully. But it is an issue of great importance, if somewhat intangible. It will require attention in any public broadcasting venture into the commercial sector.

Summary — Public Broadcasting and Videodisc Production Services

The foregoing analysis clearly indicates that public broadcasting has the skills and resources necessary to supply videodisc production services to certain segments of the emerging interactive videodisc industry. In some cases, individual public broadcasting facilities are capable of independently providing conceptualization and design, video production, and premastering services. This is true of the Nebraska Videodisc/Design Production Group and of a number of the major producing stations. Taken as a whole, public broadcasting has a range of skills and resources in each of these areas rivaled by few commercial production houses.

E. STRATEGIC OPPORTUNITIES FOR PUBLIC BROADCASTING

This chapter has explored the opportunities for public broadcasting in the emerging interactive videodisc industry in terms of both the developing markets for interactive videodisc and the stages of interactive videodisc production. It has identified a number of market opportunities for public broadcasting as a provider of videodisc production services and assessed the ability of PTV to fill that role in the viable markets.

Given public broadcasting's mission, experience, capabilities, and culture, it is best suited to serve the educational market. Public broadcasting has clearly been, and will continue to be, a dominant force in educational and instructional television. Much of its experience in videodisc production, particularly at the Videodisc Design/Production Group, has involved videodisc design for use in educational institutions. As a group of non-profit organizations, the culture of public broadcasting resembles and functions well in partnership with that of educational institutions.

But a significant educational market for interactive videodiscs is not expected to develop before 1988 — and even this date is optimistic. The development of this market is hampered by the tightening of educational budgets under the impact of declining enrollments and reductions in government expenditures for educational programs. Educational institutions are unlikely to invest in interactive videodisc technology before this budget shrinkage is eased by additional funding, whether from government sources or foundation grants.

Education in business and industrial settings goes by the name of "training." Various training applications currently represent the largest single market for interactive videodisc software and hardware. Because the competencies required to produce interactive discs for the training market are the same as those required by the educational market, public broadcasting possesses the skills and resources necessary to serve the training market. Within this market, product marketing training is the only segment inappropriate for public broadcasting, primarily because this segment will be governed by existing relationships between client companies and vendors in the advertising industry. By serving the training market over the next few years, public broadcasting will be able to maintain the knowledge and facility in interactive videodisc production necessary to serve the educational market once it develops, as well as the publishing market, which is expected to mature late in the decade.

Aside from the training market, only cataloging and archiving represent viable near-term opportunities for public broadcasting. Both involve fairly mechanical transfer processes which can be performed most economically through mass production. In most cases the competitive edge will belong to those who are able to invest in specialized, high-volume plants dedicated to production for these markets. It is questionable whether such investment lies within the mission of public broadcasting. Moreover, neither archiving nor cataloging will produce a demand for conceptualization and design services, which are crucial in educational applications. Thus a near-term involvement in cataloging and archiving will not prepare public broadcasting as well for a role in the educational market as will involvement in training.

Implications for Public Broadcasting

Given the foregoing conclusions about the opportunities interactive videodisc production holds for public broadcasting, two primary objectives for further involvement in the industry seem appropriate:

- To establish a strong position for public broadcasting in the emerging interactive videodisc industry by building interactive videodisc skills and experience across the entire public broadcasting system, and
- To move the primary long-term market for public broadcasting — educational applications — towards realization.

Three strategic moves are prerequisite to accomplishing these objectives; public broadcasting should:

- Maintain its established position in the videodisc industry,
- Build its capacity for conceptualization and design services, and
- Ensure that technical production and premastering skills are widely dispersed throughout the system.

The work of the Nebraska Videodisc Design/Production Group and those stations which have produced interactive discs in cooperation with various clients has given public broadcasting a position on the cutting edge of interactive videodisc development. This position will prove to be a valuable asset as the industry grows. If this position is not nourished, it will erode quickly; and if it is abandoned now, it will be very expensive to replace later. Moreover, participation in the development of a technology with such evident potential as an educational and training tool is clearly congruent with the mission of public broadcasting.

Conceptualization and design skills are crucial in the production of highly interactive educational discs, and public broadcasting has a distinctive strength in this area. This strength should be developed and fostered throughout the system. Because conceptualization and design begins the videodisc production process, skill in this area serves as a point of leverage over the entire production process. Moreover, public broadcasting's position of strength in this area is defensible, particularly in the training and educational markets.

Systemwide development of production and premastering skills will afford public broadcasting a breadth of geographical coverage that commericial production houses will have difficulty matching. In serving many market segments, this breadth will be an important competitive strength. These technical skills are required for any involvement in the industry — conceptualization and design skills that are not linked to production and premastering skills of comparable quality will find little market —

particularly in applications like training and education, which require a high level of interactivity. Public broadcasting already has some of the best-equipped and well-staffed production facilities in the country, so that incorporating the skills necessary for videodisc production should be a relatively easy task.

Maintaining public broadcasting's current position in the videodisc industry and spreading design and technical skills across the system are prerequisites to continued PTV involvement in the industry. But additional actions will be required in order to achieve the primary objectives noted above.

First, in attempting to develop the educational market for interactive videodisc, public broadcasting should pursue the following objectives:

- To learn more about the needs of educational institutions for instructional media media and determine how those needs can be effectively met through the use of interactive videodisc technology.
- To demonstrate to educators the potential of interactive videodisc as a teaching tool.
- To build a library of interactive videodisc course material as a way of overcoming the lack of educational software.

These objectives can best be achieved if they are approached on a national scale through the collective efforts of the public broadcasting community. Such an effort would utilize:

- Educational technology skills resident at stations clearly associated with major educational institutions (WNET, WGBH, etc.).
- Interactive videodisc skills resident in the Nebraska Videodisc Design/Production Group and at stations with videodisc experience.
- Systemwide production skills.
- Systemwide ties to the educational infrastructure.

With these resources and objectives public broadcasting can seek federal, state, and foundation funds for continued research and development into the educational use of interactive videodisc technology.

Secondly, in attempting to strengthen its position in the videodisc industry and preparing to serve the educational market, public broadcasting, acting through organs such as the enterprise divisions present at a number of stations, should seek videodisc production business in the training market. The objectives of this course would include:

- Supporting continued research and development efforts in educational applications of videodisc technology.
- Augmenting public broadcasting's experience in such applications.

- Positioning public broadcasting to serve both the needs of educational institutions as this market develops and the need to retrain the American labor force as the nation's economy continues to shift from manufacturing toward services.

- Providing a measure of financial support for the overall operations of public broadcasting.

Although a number of public stations and the Nebraska Group can and have unilaterally taken on interactive videodisc business, much could be gained from a coordinated effort. Many of the major stations have production and post-production facilities superior to those at Nebraska; but, on the other hand, none has developed the skills in conceptualization and design that VDPG possesses. Many of the closest relationships with the educational community belong to stations within universities, yet such stations often have relatively antiquated facilities. A systemwide approach to the training market offers the possibility of capitalizing on the strengths disbursed across the system and promises more success than unilateral efforts.

Implementing such a systemwide approach will require establishing a central clearinghouse for information and training in videodisc production, as well as to give public broadcasting's efforts the high profile necessary to attract clients from business and industry. The need for such a clearinghouse suggests, first, that the Nebraska Videodisc Design/Production Group be maintained. Its focus, however, could be more usefully shifted toward production, premastering, and technological issues such as hardware development. Its conferences and symposia in these areas should continue as a mechanism for disseminating the results of its work. In addition, it should serve as a training ground for production, post-production, and premastering services for institutions and for those stations unable to take on these tasks.

Secondly, a second center specializing in conceptualization and design should be developed nearer major markets and with firm ties to educational institutions strong in educational technology and interactive media. WNET, WGBH, and WQED, among others, are possible locations. This second center would handle research into and conferences on conceptualization and design, train station personnel in this area, and provide design services to stations unable to perform this task.

In addition to these actions, it may be appropriate to establish a larger presence in the developing industry by creating a consortium of stations to market videodisc production services. Such a consortium would make it possible for stations to trade capacity and services and could provide backup capacity for stations approached with projects which exceed their own capacity.

The prospects for interactive videodisc are only beginning to materialize, yet the medium has vast potential. The widespread use of interactive videodisc has been slow to develop not because of flaws in the technology, but rather because its developers have been slow in discovering those applications which best realize the technology's unique possibilities. And, like other media in the early stages of their introduction, videodisc has been hampered by the ever-present chicken-and-egg problem: neither hardware nor programming can be birthed independently.

Nevertheless, on a sector-by-sector and application-by-application basis, interactive disc continues to grow. Given the potential educational value of the medium, and its video ancestry, it is appropriate that the public broadcasting community nurture the fledgling and guide its growth. The nourishment provided and the directions encouraged, however, must be left to the collective good judgement of that community.

APPENDIX

GOVERNMENT TRAINING EXPENDITURES

Government reporting practices divide statistics on the training of government employees into four major areas: military personnel, U. S. Postal Service employees, Civil Service employees, and the employees of state and local governments.

Military Training

The Department of Defense, in its Military Manpower Training Report for FY82, reports expenditures of just over $10 billion for training in the 1981 fiscal year. This figure accounts for the cost of training individuals, as opposed to the training of operational mission units or crews. Individual military training includes basic training of new recruits, training of new officers, military professionals, pilots, and others learning specialized skills. (However, the costs of the ROTC program are not included in the figures discussed here.)

Department of Defense Expenditures for Individual Military Training

Billions of Dollars

1981	1983	1984	1986	1988	1990	Annual Growth '81-'90
$10.0	$14.6	$17.1	$23.6	$32.5	$44.8	18.1%

DoD projects total training expenditures of $12.8 billionin 1983. A comparison of past projections with actual expenditures suggests that increasing this figure by about 14% would provide a more accurate assessment of probable spending. Thus expenditures of $14.6 billion can be expected in 1983. Projections for the ensuing years are based on historic growth of expenditures for military training. At an annually compounded growth rate of just under 18%, total expenditures for military training should exceed $44 billion by the end of the decade.

The standard appropriations categories used to define the defense budget do not readily disclose the software component of military training costs. In 1981, slightly more than $160 million of the training budget went towards non-weapon procurements, an appropriations category which would include some training software. But the range of material encompassed by this area is too large and ambiguous to provide much insight into the DoD investment in mediated training materials. Moreover, training materials related to the operation and maintenance of weapons systems, aircraft, and other military equipment are typically accounted for in the total appropriations for the specific piece of equipment.

Since line items in the military training budget fail to disclose software expenditures, a rough estimate must be based on training software expenditures in industry and civil service relative to overall training costs. Software costs are typically about 14% of total training costs in both cases. Applying this figure to DoD expenditures, 1983 spending for military training software would come to $2 billion — an amount that could be expected to triple by 1990. It should be noted again that this spending takes into account only individual training and thereby excludes expenditures for the training of operational units.

A substantial proportion of DoD training costs go towards the operation and maintenance of increasingly complex aircraft, tanks, and other weapons systems. The costs of training military personnel to use these weapons occupy at least 37% of total projected spending in 1983. Rising costs of equipment and fuel, safety considerations, and other factors have spurred increasing investments by DoD in simulators that can be used to supplement and replace actual hands-on training. The Air Force is committed to a $1.8 billion program extending from 1973 to 1985 for the development of aircraft flight and maintenance simulators. The current funding level for the project is $130 million per year, an amount expected to double by 1984. The Army projects to spend $240 million for simulator purchase and development in 1983; the Navy and Marines, $330 million. Simulation training represents a significant possible application for interactive videodisc technology which will be discussed in greater detail in the next chapter.

Postal Service Training

The bulk of U. S. Postal Service employee training is administered and directed by the Postal Service Training and Development Institute (PST&DI). The most recent data available on the budget of this agency show total operating costs of over $16 million for FY 1980, an increase of 19% over the previous year.

U. S. Postal Service Training Institute Expenditures

Millions of Dollars

1979	1980	Annual Growth '79-'80	1982	1984	1986	1988	1990
$13.7	$16.3	18.9%	$23.1	$32.7	$46.2	$65.5	$92.7

Attempting to abstract expenditures for training software from the PST&DI budget would be inappropriate; the agency functions primarily to develop training software for the Postal Service, as well as to train USPS managers and trainers. One might reasonably say, then, that the PST&DI's budget itself constitutes the Postal Service's expenditures for training software.

USPS does not publish estimates of the costs of trainer and trainee salaries. Applying the assumptions used above to estimate total industry training expenditures — that is, assuming that software expenditures account for about 14% of the overall costs of training — USPS expenditures for training in 1980 totalled an estimated $116 million. If growth in total expenditures parallels the growth of software costs, by 1990 overall spending for Postal Service training would exceed $660 million.

PST&DI includes a Media Branch which produces training software in video and other audiovisual media, as well as print. Poor reading skills among Postal employees have resulted in significant exploration and use of training media that can replace written programmed instruction. PST&DI devotes considerable energy to the investigation of new training media. Both interactive videodisc and computer-aided-instruction were studied in 1980. Independent budget data for the Media Branch of PST&DI is not available.

Civil Service Training

The U.S. Office of Personnel Management (OPM) issues an annual report on the training of federal employees other than military personnel and postal workers, employees formerly called the "civil service." The latest available report describes training in fiscal year 1980. The table below provides training expenditures data from that report and projections to 1990 based on historic trends.

Civil Service Training Expenditures

Costs	Millions of Dollars						
	1980	1982	1984	1986	1988	1990	Annual Growth '82-'90
Direct	$107.3	$123.6	$142.7	$165.0	$190.7	$220.5	7.5%
Indirect	91.9	105.9	122.3	141.3	163.3	188.9	7.5%
Trainers	128.1	154.3	185.9	223.9	269.7	324.8	9.8%
SubTotal	$327.3	$383.8	$450.9	$530.2	$623.7	$734.2	8.4%
Trainee Salaries	351.8	367.5	405.2	446.7	492.5	543.0	5.0%
Total	$679.1	$751.3	$856.1	$976.9	$1,116.2	$1,277.2	6.9%

"Direct costs" include that portion of the budget devoted to training materials as well as tuition and fees paid for standard educational experiences in non-government institutions. Direct costs were $107.3 million, or 15.8% of total training expenditures, in 1980. About 76% of direct costs went for tuition and fees; subtracting this portion leaves $79.4 million in 1980 expenditures for mediated materials. This figure, assuming historic trends persist, will double by 1990.

State and Local Government

The three categories discussed above — military training, Postal Service training, and civil service training — account for the bulk of training carried out by the federal government. State and local governments are also involved in training their employees, but data on the costs they incur are practically non-existent. It seems reasonable to suspect that these governments engage in significantly less employee training than federal agencies. On the other hand, state and local governments employ 7-8 times as many workers as the federal government (excluding military and Postal Service personnel). In light of these considerations, it is not unreasonable to expect, broadly speaking, that state and local government training expenditures amount to four or five times the costs incurred by the federal government in training civil servants. Spending at this level would amount to about $4 billion in 1982.

cpb

1111 16th Street NW
Washington DC 20036
(202) 293-6160